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THE ORBIT OF SATELLITE 1958 ALPHA (EXPLORER I)
DURING THE FIRST 10500 REVOLUTIONS

by

Pedro E. Zadunaisky¹

This paper presents the results of a computation of mean orbital elements of Satellite 1958 Alpha, the first American satellite, at two-day intervals during the entire period from February 6, 1958 (5 days after launching time), until April 30, 1960. An analysis of these results is being prepared for later publication. The computations have been made by use of a machine program of differential corrections designed by G. Veis and C. Moore at the Smithsonian Observatory (Veis, 1960).

The observations used came from three main sources; Minitrack, Smithsonian Baker-Nunn photographic tracking, and Moonwatch stations. To these three types of observations we assigned relative accuracies of, respectively, 660, 184, and 3300 seconds of arc. In the differential correction process, made according to the method of least squares, the weights assigned to the corresponding equations of condition were the reciprocals of the squares of these numbers.

The radio transmitters contained on the satellite operated for nearly four months and during that early period they were almost the only source of observations. When the radio transmitters stopped operating on May 23, 1958, observations of other types were very scarce until July 6, 1958, when it was possible to resume the computation on the basis of reliable observations. This and other minor gaps in our computations are due to a similar lack of observations.

The word "mean" referring to the orbital elements presented here must be understood in two senses. First, the word indicates that the first-order short-period perturbations due to the oblateness of the Earth have been computed analytically (Kozai, 1960) and subtracted from the observations before the differential correction of the elements was performed. Secondly, the elements are mean in the sense that they represent observations distributed over a period of several days. It is true, however, that the elements of such an orbit are not represented by constants but by polynomial, sine, and eventually exponential functions of the time. These functions were chosen, for convenience, to represent in an empirical way the secular and long-period perturbations resulting from the non-spherical form of the Earth and from atmospheric drag. The numerical values of the coefficients involved in these functions were refined by a process of successive approximations as follows.

At the beginning it was found (Teske, 1958) that the orbital elements could be most simply represented by breaking the first three months of the life of the satellite into segments of about a week, and fitting polynomial expressions for the perturbed elements to each of the

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segments. The coefficients of these polynomials were found mostly by combining theory and successive empirical corrections of the elements already known at the time the satellite went into orbit. In this way the argument of perigee (ω), the right ascension of the ascending node (Ω), and the mean anomaly were represented by quadratic polynomials; the eccentricity (e) was represented by a linear expression, and the inclination (i) by a single constant term. Using these expressions as input for the machine program, we corrected only the first coefficient of each polynomial at each two-day interval, but we kept the other elements constant for periods of one to two weeks. In the mean anomaly we corrected, also every two days, the three coefficients of the quadratic polynomial in order to take into account the rapid and unpredictable changes in the atmospheric drag.

Those corrections were made in order to make the elements consistent with the observations of the satellite during a particular period of 6 days, 3 days before and 3 days after the epoch of the elements. Since any two successive epochs are separated by an interval of 2 days, the corresponding periods of 6 days overlap on 4 days; this method assures a better continuity in our results. The period of 6 days to be represented by a single set of elements (expressed as polynomial plus sine functions of time) proved to be optimum in this computation. A period of 8 days yielded results that were too much smoothed; a period of 4 days was too short to accumulate enough observations and the results were rather unstable. Using this method of correcting the first coefficient of the polynomial representing each element, every two days, we covered the first three months of the life of the satellite. The computation continued by the procedure described above, which used as a first approximation for each epoch the results corresponding to an epoch two days before. Step by step, we computed the orbital elements every two days for the entire life of the satellite through April 30, 1960.

Next we started a new stage of the computation, considering 7 successive periods of about 5 months each. For each period we represented the elements by quadratic polynomials obtained by a least squares fit to the coefficients already corrected. This time we also added to each polynomial a sine (or cosine) term corresponding to the effects of the third harmonics term in the gravitational potential of the Earth, computed theoretically (Kozai, 1959a). Thus each element was represented by an expression of the form

$$E = E_0 + E_1(T - T_0) + E_2(T - T_0)^2 + E_4 \left\{ \begin{matrix} \sin \\ \cos \end{matrix} \right\} \omega , \quad (1)$$

ω being the argument of perigee. We then repeated the whole process of correction of the coefficients E_0 of all the elements, and of the linear and quadratic coefficients M_1 and M_2 in the mean anomaly. This time the positions computed with the new elements agreed much better, in general, with the observations; in certain periods the computation was repeated once more, to obtain a better fit to the observations.

The final results are shown in Table 1, which covers successive periods of two months each. The first column gives the Modified Julian Date (MJD) of the epoch of the elements; this is merely the actual Julian Date from which, to avoid repetition, the number 2400000.5 has been subtracted. The following four columns give the argument of perigee (ω), the right ascension of the ascending node (Ω), the inclination (i), and the eccentricity (e). The single digit placed at the right of each value represents the standard error and affects the last digit given. The mean anomaly (M) and the anomalistic mean motion (n) have been computed from the corresponding polynomial plus a sine expression, as given in equation (1), for the epoch T , whereas n' is the value of the third coefficient (M_2) of that polynomial at the same epoch. The following three columns contain the geocentric distance of the perigee (q) in megameters, the number of observations used (N), and the number of days (D) along which these observations were distributed. The last column gives the standard deviation (σ) or mean quadratic error of a single observation whose weight is unity.

The fundamental system of reference of these elements is that defined in Smithsonian Special Report No. 40(R), page 2. The reference plane is the true equator of date, and the origin of right ascension is a line shifted from the mean equinox of the date by an amount equal to the precession in right ascension between 1950.0 and the date. Therefore the right ascension of the ascending node (Ω) given in Table 1 may be transformed into a right ascension referred to the mean equinox of date (Ω') by means of the simple formula,

$$\Omega' = \Omega + 3^{\circ}508 \times 10^{-5} \times (\text{MJD} - 33281).$$

In Table 2 we give some data that are especially related to the perturbing effects of atmospheric drag. The column heads have the following meanings: MJD is the actual Julian Date minus 2400000.5; \dot{P} is the rate of change in period in days per day; Z is the perigee height (in km) above the international ellipsoid; ϕ is the latitude of perigee; D.R.A. is the right ascension of perigee minus the right ascension of the sun; and ψ is the geocentric angular distance between perigee and the sun. We have computed the rate of change of the period, \dot{P} , by using for the mean anomaly the expression,

$$M = M_0 + M_1(t - t_0) + M_2(t - t_0)^2,$$

thus neglecting the sine term whose effect is small. Then the mean anomalistic motion is given by the relation,

$$n = dM/dt = M_1 + 2M_2(t - t_0);$$

the period is $P = 1/n$ and the rate of change of the period is $\dot{P} = -2M_2/n^2$. The other data, which refer to the recently discovered correlation between solar activity and variation of the atmospheric density (Jacchia, 1959; 1960) were computed as explained in Zadunaisky (1960).

We also give a graphical representation of our results as functions of time. In all cases except that of the rate of change of the period, we have plotted the residuals of the given element against a quadratic or linear equation obtained by a least squares fit which contains the secular part of the variation of the element. On the axis of time we have marked the zero day of each month, and the Modified Julian Date at 10-day intervals.

As is well known, the atmospheric drag effect on an object such as Satellite 1958 Alpha is practically concentrated on a narrow region around perigee. The magnitude of the drag depends mainly on the atmospheric density at that point and its variations will be reflected in variations of the mean motion of the satellite. Figure 1 shows clearly the correlation existing between the geocentric angular distance from the Sun to the perigee of the satellite orbit and the mean motion of the satellite. Between the two curves there is a lag due probably to the diurnal rotation of the atmosphere (see Jacchia, 1959; 1960). On the graph corresponding to the rate of change of the period the fluctuations are erratic, but some periodic oscillations, with a period of about a month, are visible, especially during the times in which the perigee was in sunlight. A careful analysis is required to separate the purely gravitational effects from those due to variations in atmospheric drag and, possibly, solar radiation pressure. The effect of the tumbling of this non-spherical satellite seems to be in general small, except during the first few weeks after launching time.

In Figure 2, the graphs corresponding to the argument of perigee and the right ascension of the ascending node show their residuals against the quadratic expressions,

$$\omega = \omega_0 + \omega_1 t + \omega_2 t^2, \\ \Omega = \Omega_0 + \Omega_1 t + \Omega_2 t^2,$$

with the following numerical values for the coefficients obtained by means of a least squares fit:

$$\begin{array}{ll} \omega_0 = 163^\circ 682 & \Omega_0 = 314^\circ 748 \\ \omega_1 = 6^\circ 3179/\text{day} & \Omega_1 = -4^\circ 2343/\text{day} \\ \omega_2 = 9518 \times 10^{-3}/\text{day}^2 & \Omega_2 = 9346 \times 10^{-3}/\text{day}^2 \end{array}$$

When only secular perturbations of the first order are taken into account the analytical expressions of ω_1 and Ω_1 are, respectively (Kozai, 1959b),

$$\omega_1 = \frac{A_2}{p^2} n \left(2 - \frac{5}{2} \sin^2 i \right) t, \\ \Omega_1 = - \frac{A_2}{p^2} n t \cos i,$$

where A_2 is the coefficient of the second harmonics term in the gravitational potential of the Earth, and p is the parameter of the elliptic orbit of the satellite, which can be written in the form,

$$p = a(1 - e^2) = q(1 + e),$$

q being the distance from perigee to the center of the Earth. From our tables we can see that, from satellite launching to the present time, q diminished by an amount of a few thousandths of an earth radius and i had a maximum variation of a few hundredths of a degree. Then considering q and i as constants and putting $\omega_2 = \dot{\omega}_1/2$ and $\Omega_2 = \dot{\Omega}_1/2$, we find it is not too difficult to obtain, after some transformations:

$$\omega_2 = \frac{1}{6} \frac{7-e}{1+e} \dot{n} \omega_1,$$

$$\Omega_2 = \frac{1}{6} \frac{7-e}{1+e} \dot{n} \Omega_1.$$

Therefore we should have, approximately,

$$\frac{\omega_2}{\Omega_2} = \frac{\omega_1}{\Omega_1} = - \frac{2 - \frac{5}{2} \sin^2 i}{\cos i}.$$

If we use for i the value of $33^\circ 2$, we obtain

$$-\frac{2 - \frac{5}{2} \sin^2 i}{\cos i} = -1.493,$$

whereas

$$\frac{\omega_1}{\Omega_1} = -\frac{6.3179}{4.2343} = -1.492, \quad \frac{\omega_2}{\Omega_2} = -\frac{.518}{.346} = -1.497,$$

in good accordance with the theory.

The effects of the variations of n upon ω and Ω , although somewhat smoothed, are clearly visible on the curves of Figure 2. The graph of the argument of perigee (ω) shows a periodic perturbation, with a period of about two months, which is probably due to the effects of the asymmetry of the Earth with respect to its equatorial plane. The same effects can be noticed on the graphs corresponding to the eccentricity (Fig. 3) and to the distance between the perigee and the center of the Earth (Fig. 4).

Finally we computed the lifetime of this satellite by using the approximate formula (see Kornford, 1958, p. 13),

$$t_L = \frac{e \times (6 + 7e) \times n}{2920 \times \dot{n}},$$

which gives the results in years when n is measured in revolutions per day. We computed the values of n and e for April 30, 1960, using the formulas given in Figures 1 and 3, by which we obtain $t_L = 2.19$ years. This result means that the demise of the satellite, Explorer I, should occur around the month of July, 1962.

Most of the material work of handling the computing machine programs and making the graphical representation was done with care and diligence by Mr. Jay C. Tapp and Mrs. Beatrice Miller, to whom I express my thanks.

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TABLE 1

 ORBITAL ELEMENTS OF THE SATELLITE 1958 ALPHA
 FEBRUARY - MARCH, 1958

T (MJD)	ω	Ω	i	e	M	n	n'	q	N	D	σ
36240.0	151.01 5	322.67 2	33.23 1	.14005 8	.6118 2	12.53008 1	.430E-3 8	6.73214	25	6	1.19
36242.0	163.71 5	314.16 2	33.24 1	.13960 7	.6736 1	12.53185 1	.438E-3 8	6.73505	39	6	1.55
36244.0	176.39 4	305.70 3	33.25 1	.13945 7	.7391 1	12.53380 1	.447E-3 8	6.73555	45	6	1.54
36246.0	189.07 2	297.26 2	33.242 8	.13925 6	.8087 8	12.53580 7 6	.420E-3 5	6.73637	54	6	1.42
36248.0	201.78 3	288.83 2	33.237 9	.13923 8	.8821 1	12.53718 9	.330E-3 5	6.73592	46	6	1.63
36250.0	214.45 3	280.33 2	33.24 1	.13904 7	.95883 9	12.53897 3 7	.287E-3 5	6.73694	46	6	1.51
36252.0	226.86 5	271.79 3	33.23 2	.1391 1	1.0388 1	12.54043 2	.43E-3 1	6.73618	40	6	2.18
36254.0	239.64 4	263.35 3	33.24 1	.1390 1	1.1211 1	12.54201 1	.359E-3 7	6.73587	44	6	2.00
36256.0	252.57 2	254.89 2	33.254 9	.13873 8	1.20574 6	12.543272 6	.361E-3 4	6.73779	55	6	1.39
36258.0	265.346 6	246.397 4	33.249 2	.13853 2	1.29343 1	12.544497 2	.3491E-3 9	6.73894	53	6	.38
36260.0	278.077 7	237.900 5	33.240 3	.13853 3	1.38359 2	12.545683 2	.367E-3 1	6.73845	54	6	.49
36262.0	290.800 8	229.406 5	33.238 3	.13851 3	1.47617 2	12.546866 2	.357E-3 2	6.73821	45	6	.46
36264.0	303.53 1	220.900 5	33.238 3	.13851 3	1.57114 2	12.548095 2	.364E-3 1	6.73780	48	6	.47
36266.0	316.13 4	212.51 2	33.264 8	.13849 7	1.66869 8	12.549455 9	.381E-3 5	6.73742	55	6	1.60
36268.0	328.92 1	203.916 4	33.244 2	.13849 2	1.76916 2	12.551065 3	.422E-3 2	6.73686	72	6	.45
36270.0	341.635 7	195.418 3	33.240 1	.13853 1	1.87308 2	12.552738 2	.355E-3 1	6.73599	71	6	.30
36272.0	354.315 8	186.921 3	33.239 1	.13858 1	1.98025 2	12.554422 2	.377E-3 1	6.73493	73	6	.33
36274.0	366.96 2	178.396 7	33.237 3	.13863 3	2.09108 5	12.556262 5	.401E-3 3	6.73390	62	6	.78
36276.0	379.66 1	169.897 6	33.230 2	.13863 2	2.20553 4	12.558249 3	.432E-3 2	6.73320	60	6	.56
36278.0	392.36 1	161.377 4	33.228 1	.13860 2	2.32402 2	12.560125 2	.391E-3 1	6.73273	63	6	.45
36280.0	405.08 1	152.873 6	33.223 2	.13874 3	2.44587 3	12.561920 3	.439E-3 2	6.73103	59	6	.60
36282.0	417.75 1	144.350 5	33.220 2	.13871 2	2.57153 3	12.563700 2	.445E-3 2	6.73064	55	6	.56
36284.0	430.40 2	135.835 9	33.212 3	.13873 4	2.70068 3	12.565399 3	.459E-3 2	6.72986	54	6	.73
36286.0	443.11 6	127.31 3	33.19 1	.1385 1	2.8331 1	12.567114 9	.477E-3 7	6.73131	50	6	2.74
36288.0	455.88 4	118.75 3	33.20 1	.1381 1	2.9689 1	12.568865 9	.525E-3 5	6.73342	39	6	2.10
36290.0	468.49 6	110.29 3	33.19 2	.1382 2	3.1085 2	12.57055 1	.456E-3 7	6.73226	40	6	2.75
36292.0	481.23 6	101.66 3	33.24 2	.1379 1	3.2512 2	12.57226 1	.515E-3 9	6.73385	34	6	2.39

ORBITAL ELEMENTS OF THE SATELLITE 1958 ALPHA
APRIL - MAY - JUNE, 1958

T (MJD)	ω	Ω	i	e	M	n	n'	q	N	D	σ
36294.0	493.85 8	93.00 5	33.25 3	*1382 2	3.3981 2	12.57441 2	*666E-3 2	6.73066	34	6	3.021
36296.0	506.64 7	84.37 5	33.20 1	*1380 2	3.5492 3	12.57660 2	*53E-3 1	6.73195	37	6	3.019
36298.0	519.38 8	75.89 5	33.20 1	*1383 1	3.7046 3	12.57894 2	*56E-3 1	6.72817	47	6	3.048
36300.0	532.10 6	67.56 4	33.235 9	*1384 1	3.8644 2	12.58128 2	*529E-3 9	6.72720	49	6	2.87
36302.0	544.85 5	58.98 2	33.20 1	*13740 9	4.0296 2	12.58347 1	*438E-3 8	6.73383	49	6	1.93
36304.0	557.50 1	50.513 6	33.243 3	*13710 2	4.19865 4	12.585372 3	*368E-3 2	6.73547	45	6	0.49
36306.0	570.292 7	41.957 3	33.241 1	*13693 1	4.37105 2	12.587018 1	*359E-3 1	6.73618	53	6	0.29
36308.0	583.15 4	33.42 1	33.217 6	*13695 7	4.5464 1	12.588596 8	*383E-3 5	6.73552	56	6	1.70
36310.0	595.87 3	24.86 1	33.226 5	*13673 6	4.72530 9	12.590273 8	*480E-3 6	6.73661	64	6	1.81
36312.0	608.67 3	16.30 1	33.227 4	*13670 6	4.90766 6	12.591988 7	*456E-3 5	6.73672	66	6	1.59
36314.0	621.441 8	7.745 3	33.241 9	*13645 2	5.09330 2	12.593577 2	*459E-3 1	6.73758	61	6	0.42
36316.0	634.253 9	-817.4	33.2407 9	*13639 2	5.28203 2	12.595149 2	*459E-3 1	6.73753	59	6	0.44
36318.0	647.08 3	-9.38 1	33.240 4	*13634 7	5.47384 7	12.596826 6	*504E-3 4	6.73732	58	6	1.49
36320.0	659.93 3	-17.94 1	33.237 5	*13626 8	5.66921 8	12.598661 7	*502E-3 4	6.73729	57	6	1.61
36322.0	672.72 4	-26.52 2	33.266 7	*13621 9	5.8685 1	12.60064 1	*527E-3 5	6.73694	57	6	1.92
36324.0	685.57 5	-35.14 2	33.271 7	*13624 9	6.0720 1	12.60276 1	*505E-3 7	6.73599	58	6	1.96
36326.0	698.39 4	-43.72 2	33.274 7	*13625 8	6.2796 1	12.60470 1	*398E-3 6	6.73517	57	6	1.70
36328.0	711.19 2	-52.17 1	33.218 5	*13626 4	6.49059 8	12.606595 6	*404E-3 4	6.73443	52	6	0.93
36330.0	723.973 9	-60.801 5	33.231 2	*13630 2	6.70583 3	12.608529 2	*411E-3 1	6.73347	57	6	0.40
36332.0	736.76 1	-69.422 7	33.243 3	*13632 2	6.92491 4	12.610418 2	*407E-3 2	6.73265	48	6	0.46
36334.0	749.569 8	-78.001 4	33.238 2	*13632 2	7.14751 3	12.612215 2	*389E-3 1	6.73194	44	6	0.29
36336.0	762.37 1	-86.586 9	33.247 5	*13638 4	7.37352 4	12.613871 3	*408E-3 2	6.73096	44	6	0.64
36338.0	775.18 1	-95.171 7	33.232 4	*13640 3	7.60277 3	12.615470 4	*415E-3 2	6.73018	41	6	0.51
36340.0	787.94 2	-103.78 1	33.218 5	*13640 4	7.83535 4	12.617010 4	*413E-3 3	6.72962	38	6	0.90
36342.0	800.71 3	-112.39 2	33.227 9	*13633 7	8.07084 7	12.618444 8	*433E-3 4	6.72967	39	6	1.93
36344.0	813.47 1	-120.950 8	33.224 3	*13625 3	8.30914 3	12.619886 2	*410E-3 2	6.72981	38	6	0.67
36346.0	826.22 2	-129.56 1	33.221 2	*13623 5	8.55037 3	12.621318 3	*429E-3 2	6.72946	43	6	0.98
	36348.0				36388.0						

ORBITAL ELEMENTS OF THE SATELLITE 1958 ALPHA
JULY - AUGUST, 1958

T (MID)	ω	Ω	i	e	M	n	n'	q	N	D	σ
36390.0	1109.45 4	-319.14 1	33.231 7	.13420 9	14.6362 1	12.655683 9	.456E-3 5	6.73301	38	6	1.65
36392.0	1122.42 7	-327.83 2	33.24 1	.1340 2	14.9493 2	12.657733 8	.528E-3 5	6.73380	33	6	2.46
36394.0	1135.4 2	-336.51 4	33.24 2	.1338 3	15.2664 6	12.65979 2	.52E-3 1	6.73466	24	6	4.01
36396.0	1147.8 1	-345.09 2	33.25 2	.1346 2	15.5898 3	12.66171 2	.41E-3 1	6.72749	29	6	1.81
36398.0	1161.1 3	-353.9 1	33.17 6	.1344 4	15.9138 9	12.66314 4	.22E-3 3	6.72913	36	6	6.05
36400.0	1173.65 8	-362.47 2	33.21 1	.1344 1	16.2425 3	12.664744 8	.377E-3 5	6.72838	37	6	1.80
36402.0	1186.84 9	-371.11 2	33.21 1	.1338 1	16.5725 3	12.66631 1	.387E-3 5	6.73258	31	6	1.90
36404.0	1199.8 1	-379.77 2	33.19 1	.1336 1	16.9064 3	12.667866 9	.392E-3 5	6.73362	28	6	2.28
36406.0	1212.8 2	-388.44 3	33.18 2	.1333 1	17.2434 6	12.66945 2	.42E-3 2	6.73539	19	6	2.37
36408.0	1224.1	-397.09 6	33.26 7	.1337 5	17.588 3	12.67114 6	.44E-3 2	6.73121	8	6	3.40
36410.0	1238.17 4	-405.73 1	33.226 3	.13345 3	17.9290 1	12.67327 1	.514E-3 6	6.73267	45	10	.77
36412.0	1251.10 4	-414.41 1	33.226 3	.13326 3	18.2775 1	12.675314 8	.514E-3 6	6.73338	45	6	.77
36414.0	1264.04 4	-423.087 9	33.226 3	.13299 3	18.6302 1	12.677434 6	.570E-3 4	6.73476	52	6	.86
36416.0	1277.01 3	-431.760 7	33.226 2	.13280 2	18.9873 1	12.679719 4	.582E-3 2	6.73539	56	6	.81
36418.0	1290.13 6	-440.44 1	33.225 3	.13263 3	19.3486 2	12.681988 7	.559E-3 6	6.73592	29	6	.76
36420.0	1303.6 1	-449.08 2	33.23 1	.13221 1	19.7130 4	12.68420 1	.58E-3 1	6.73878	26	6	1.81
36422.0	1316.18 3	-457.815 6	33.223 3	.13225 3	20.0849 1	12.686109 6	.474E-3 5	6.73739	31	6	.68
36424.0	1329.06 2	-466.504 4	33.224 1	.13216 2	20.45947 6	12.688057 5	.484E-3 2	6.73741	60	6	.51
36426.0	1342.08 2	-475.195 4	33.225 1	.13205 2	20.83750 6	12.689981 3	.483E-3 1	6.73762	67	6	.50
36428.0	1355.08 2	-483.895 4	33.227 1	.13187 2	21.21946 6	12.691896 3	.482E-3 2	6.73829	54	6	.42
36430.0	1368.06 4	-492.592 6	33.234 3	.13194 4	21.6053 2	12.693783 6	.491E-3 4	6.73711	34	6	.85
36432.0	1381.18 5	-501.277 8	33.235 4	.13188 4	21.995 2	12.695847 6	.523E-3 3	6.73684	31	6	1.18
36434.0	1394.16 3	-509.983 6	33.232 3	.13179 3	22.38844 9	12.697977 4	.537E-3 4	6.73676	31	6	.77
36436.0	1407.25 6	-518.68 1	33.231 7	.13174 5	22.7864 2	12.700191 8	.551E-3 6	6.73638	31	6	1.44
36438.0	1420.27 3	-527.402 6	33.228 4	.13162 3	23.1889 1	12.70265 1	.652E-3 7	6.73644	28	6	.53
36440.0	1433.20 9	-536.12 1	33.242 8	.13164 6	23.5972 3	12.705394 7	.700E-3 9	6.73529	32	6	1.08
36442.0	1446.22 6	-544.84 1	33.232 5	.13177 5	24.0109 2	12.70860 1	.822E-3 6	6.73319	33	6	.75
36444.0	1459.32 4	-553.35 1	33.234 4	.13172 5	24.4311 1	12.711816 5	.789E-3 3	6.73244	41	6	1.13
36446.0	1472.34 4	-562.267 9	33.235 3	.13156 5	24.8579 1	12.714923 6	.744E-3 5	6.73260	33	6	.85

ORBITAL ELEMENTS OF THE SATELLITE 1958 ALPHA
SEPTEMBER - OCTOBER, 1958

T (MJD)	ω	Ω	i	e	M	n	n'	q	N	D	σ
36448.0	1485.28 4	-571.00 1	33.235 5	•13144 5	25.2910 1	12.718094 4	•797E-3 3	6.73241	33	6	1.20
36450.0	1498.37 6	-579.77 2	33.25 1	•1316 1	25.7302 2	12.72135 2	•837E-3 9	6.72962	21	6	1.28
36452.0	1511.34 6	-588.49 2	33.243 8	•1314 1	26.1763 2	12.724618 8	•812E-3 4	6.73045	27	6	1.49
36454.0	1524.23 3	-597.22 1	33.241 6	•1311 1	26.6292 1	12.72779 1	•75E-3 1	6.73148	16	6	1.10
36456.0	1537.16 3	-606.00 1	33.242 5	•1308 1	27.0880 1	12.730803 8	•765E-3 3	6.73290	17	6	•83
36458.0	1550.30 4	-614.71 3	33.24 2	•1309 1	27.5521 2	12.73393 1	•807E-3 4	6.73132	13	6	1.17
36460.0	1563.3 2	-623.44 4	33.26 4	•1304 4	28.0232 4	12.73720 2	•82E-3 2	6.73374	15	6	5.10
36462.0	1576.39 4	-632.22 1	33.246 8	•1306 2	28.5006 1	12.74053 2	•867E-3 6	6.73061	14	6	•88
36464.0	1589.42 3	-640.98 1	33.244 9	•1302 1	28.9852 1	12.743849 7	•814E-3 7	6.73328	16	6	1.35
36466.0	1602.42 4	-649.748 9	33.25 1	•1301 1	29.4765 1	12.746945 8	•729E-3 7	6.73251	16	6	•90
36468.0	1615.50 2	-658.522 8	33.241 3	•12991 5	29.97328 5	12.749852 4	•700E-3 4	6.73301	25	6	•91
36470.0	1628.60 2	-667.303 8	33.240 3	•12972 5	30.47575 4	12.752652 5	•701E-3 4	6.73350	22	6	•81
36472.0	1641.74 2	-676.08 1	33.241 3	•12954 6	30.98392 6	12.755687 3	•775E-3 2	6.73381	27	6	•99
36474.0	1654.7 2	-684.95 7	33.24 3	•1292 7	31.4991 7	12.75884 6	•78E-3 3	6.73578	25	6	6.73
36476.0	1668.11 7	-693.66 1	33.240 4	•1291 1	32.0185 2	12.76169 2	•748E-3 8	6.73516	23	6	•96
36478.0	1680.5 6	-702.44 3	33.24 2	•1288 2	32.547 2	12.76471 4	•763E-3 2	6.73636	15	6	1.07
36480.0	1695. 2	-711.2 1	33.25 6	•128 2	33.075 6	12.76762 3	•72E-3 2	6.73830	14	6	1.91
36482.0	1707.3 7	-720.1 1	33.24 2	•1278 7	33.616 3	12.77049 4	•73E-3 4	6.74218	21	6	2.00
36484.0	1720.6 5	-728.90 5	33.240 6	•1284 5	34.160 3	12.77323 1	•630E-3 8	6.73645	36	6	2.10
36486.0	1734.1 4	-737.66 3	33.237 4	•1287 4	34.708 2	12.777572 1	•611E-3 6	6.73330	38	6	1.71
36488.0	1747.7 3	-746.46 2	33.231 4	•1291 4	35.260 1	12.778229 6	•647E-3 4	6.72960	33	6	1.28
36490.0	1760.2 2	-755.31 2	33.238 6	•1281 3	35.8217 8	12.780836 4	•648E-3 3	6.73636	27	6	•79
36492.0	1774.0 4	-764.10 3	33.23 1	•1288 9	36.384 2	12.783561 9	•723E-3 6	6.72985	23	6	1.33
36494.0	1786.7 3	-772.94 2	33.23 1	•1284 6	36.955 1	12.786457 6	•741E-3 5	6.73224	17	6	•68
36496.0	1800.0 3	-781.77 2	33.23 1	•1284 6	37.531 1	12.789431 6	•740E-3 5	6.73048	18	10	•68
36498.0											
36500.0											
36502.0	1839.1 5	-808.28 3	33.22 2	•127 1	39.298 2	12.798873 9	•768E-3 2	6.73689	20	6	2.16
36504.0											

ORBITAL ELEMENTS OF THE SATELLITE 1958 ALPHA
NOVEMBER - DECEMBER, 1958

(MJD)	ω	Ω	i	e	M	n	n'	q	N	D	σ
36514.0											
36516.0	1931.2 2	-870.45 8	33.208 8	.1294 3	43.6191 5	12.8173 3	*56E-3 2	6.71346	25	6	4.50
36518.0	1944.7 1	-879.09 6	33.24 1	.1276 3	44.2553 3	12.81959 2	*56E-3 6	6.72615	21	6	1.72
36520.0	1957.8 1	-887.83 8	33.25 1	*1269 4	44.8967 3	12.82175 1	*51E-3 1	6.73104	19	6	1.84
36522.0	1970.4 7	-896.7 3	33.30 5	.126 4	45.545 2	12.82386 5	*37E-3 3	6.73500	24	8	9.11
36524.0	1983.3 6	-905.7 2	33.33 5	.125 6	46.195 6	12.82552 3	*42E-3 2	6.74126	30	8	9.94
36526.0	1996.5 6	-915.2 2	33.6 1	.119 6	46.852 3	12.82723 5	*46E-3 2	6.78788	25	8	10.45
36528.0	2011.1 2	-923.63 8	33.25 4	*127 2	47.5006 7	12.82909 2	*443E-3 8	6.73068	19	8	3.65
36530.0	2024.2 2	-932.61 8	33.30 4	.128 2	48.1605 6	12.83085 3	*45E-3 2	6.71608	13	8	2.91
36532.0	2037.4 1	-941.46 5	33.26 3	.129 1	48.8239 3	12.83255 6	*43E-3 2	6.70906	11	10	1.83
36534.0											
36538.0											
36540.0	2091.22 9	-976.99 3	33.247 7	*1256 2	51.5198 2	12.84126 1	*551E-3 5	6.73447	23	10	2.59
36542.0	2104.9	-986.15 6	33.19 1	.129 9	52.2062 1	12.84341 2	*474E-3 7	6.70705	36	10	8.37
36544.0	2118.1 1	-994.84 4	33.245 8	*1257 3	52.8932 3	12.84548 2	*482E-3 5	6.73187	41	10	4.70
36546.0	2131.4 1	-1003.74 5	33.246 7	.1253 3	53.5864 3	12.84743 1	*462E-3 4	6.73420	54	10	4.47
36548.0	2144.7 1	-1012.68 5	33.243 7	*1253 3	54.2831 3	12.84930 1	*465E-3 4	6.73341	53	10	4.55
36550.0	2158.1 1	-1021.55 5	33.246 8	.122 2	54.9843 4	12.851279 7	*494E-3 2	6.75753	59	10	4.58
36552.0	2171.4 2	-1030.46 2	33.24 1	*123 2	55.6884 4	12.85328 1	*509E-3 4	6.74713	48	10	4.21
36554.0	2184.4 3	-1039.39 8	33.24 1	*126 2	56.3972 4	12.85529 1	*503E-3 6	6.72787	39	10	4.22
36556.0	2197.4 2	-1048.30 4	33.222 9	.128 2	57.1098 2	12.857158 9	*458E-3 4	6.70922	21	10	1.15
36558.0	2210.8 4	-1057.1 1	33.18 4	*126 2	57.8259 4	12.85882 3	*438E-3 6	6.72421	17	10	2.52
36560.0	2223.6 1	-1066.01 2	33.08 2	*1270 5	58.5463 2	12.86049 1	*417E-3 4	6.71666	5	10	.17
36562.0											
36564.0	2250.80 8	-1084.08 4	33.20 1	*1257 3	59.9937 2	12.86356 2	*406E-3 4	6.72592	5	10	.59
36566.0	2263.9 2	-1092.9 1	33.22 4	*1247 7	60.7224 4	12.86540 3	*371E-3 2	6.73260	9	10	1.11
36568.0											

ORBITAL ELEMENTS OF THE SATELLITE 1958 ALPHA
JANUARY - FEBRUARY, 1959

T (MJD)	ω	Ω	i	e	M	n	n'	q	N	D	σ
36572.0											
36574.0	2317.9 4	-1128.6 2	33.24 3	.1268 7	63.668 1	12.87185 4	.00043 4	6.71396	32	6	14.87
36576.0	2330.74 9	-1137.65 5	33.228 6	.1261 1	64.4153 2	12.873753 9	.000497 5	6.71877	25	6	2.57
36578.0	2343.9 1	-1146.67 5	33.224 7	.1244 1	65.1649 3	12.875777 1	.000519 8	6.73178	22	6	3.67
36580.0	2357.39 3	-1155.63 1	33.222 2	.12423 4	65.91825 8	12.877689 4	.000431 4	6.73206	22	6	.91
36582.0	2370.88 4	-1164.590 9	33.222 2	.12413 4	66.67512 9	12.879284 4	.000383 2	6.73226	38	6	1.20
36584.0	2384.26 3	-1173.46 1	33.221 6	.1238 1	67.43522 7	12.880744 3	.000349 2	6.73439	36	6	.86
36586.0	2397.69 4	-1182.48 2	33.20 1	.1238 2	68.1980 1	12.882136 6	.000353 5	6.73382	27	6	.93
36588.0	2411.1 1	-1191.48 4	33.23 1	.1239 1	68.9639 2	12.88347 2	.00034 1	6.73251	15	6	2.96
36590.0	2424.5 1	-1200.44 4	33.23 1	.1239 1	69.7322 2	12.88482 2	.34E-3 1	6.73227	15	10	2.97
36592.0											
36600.0											
36602.0	2505.0 1	-1254.29 4	33.224 5	.1233 1	74.4066 2	12.894601 6	.441E-3 3	6.73318	27	8	2.29
36604.0	2518.53 7	-1263.29 3	33.230 5	.12364 7	75.1974 2	12.896343 5	.422E-3 2	6.73008	42	10	3.14
36606.0	2531.98 6	-1272.28 2	33.230 4	.12362 6	75.9918 1	12.898086 7	.000387 4	6.72962	29	6	2.53
36608.0	2545.40 4	-1281.26 2	33.231 3	.12370 4	76.78952 9	12.899686 4	.000392 2	6.72843	33	6	1.94
36610.0	2558.78 3	-1290.25 1	33.231 2	.12375 3	77.59050 7	12.901273 4	.000394 2	6.72749	30	6	1.57
36612.0	2572.16 2	-1299.239 9	33.228 1	.12374 2	78.39464 4	12.902816 2	.000387 1	6.72708	29	6	.92
36614.0	2585.53 4	-1308.25 2	33.232 4	.12379 6	79.20192 8	12.904378 8	.000398 6	6.72612	30	6	2.10
36616.0	2598.92 4	-1317.26 3	33.231 4	.12380 6	80.01226 9	12.905993 8	.000405 9	6.72553	27	6	2.22
36618.0	2612.20 6	-1326.26 4	33.234 8	.12379 8	80.8260 1	12.907612 8	.000421 7	6.72499	14	6	1.94
36620.0	2624.4	-1335.5 8	33.23 2	.125 3	81.65 1	12.909 2	.0005 6	6.71883	5	6	1.72
36622.0	2639.12 8	-1344.24 1	33.227 4	.12345 8	82.4611 3	12.910145 8	.000340 7	6.72675	8	6	.43
36624.0	2653.2	-1353.24 8	33.3 1	.12 1	83.280 9	12.91160 3	.00041 2	6.75484	11	6	3.30
36626.0	2666.6 3	-1362.26 2	33.23 2	.118 2	84.104 1	12.913351 7	.000467 4	6.76958	19	6	1.18

ORBITAL ELEMENTS OF THE SATELLITE 1958 ALPHA

MARCH - APRIL, 1959

^T (MJD)	ω	Ω	i	e	M	n	n'	q	N	D	σ
36628.0	2679•4 2	-1371•26 3	33•24 2	•122 1	84•936 1	12•915108 9	•000424 5	6•73385	23	6	1•53
36630.0	2692•7 2	-1380•28 2	33•24 1	•1228 8	85•7684 7	12•916754 8	•000395 6	6•72962	27	6	1•32
36632.0	2706•0 2	-1389•27 3	33•241 9	•1234 8	86•6040 8	12•918271 7	•000361 4	6•72398	33	6	1•57
36634•0	2719•9 3	-1398•29 3	33•238 7	•1219 8	87•440 1	12•919710 8	•000367 5	6•73533	39	6	1•76
36636•0	2733•3 3	-1407•32 4	33•235 7	•1221 9	88•282 1	12•92114 1	•000367 6	6•73308	39	6	1•98
36638•0	2746•60 5	-1416•32 3	33•239 4	•1222 1	89•12589 9	12•922507 7	•000344 4	6•73214	45	6	1•68
36640•0	2760•02 5	-1425•31 3	33•239 4	•1219 1	89•97239 7	12•923898 7	•000362 4	6•73356	47	6	1•74
36642•0	2773•50 5	-1434•31 3	33•238 4	•1217 2	90•82168 7	12•925329 9	•000360 4	6•73510	38	6	1•59
36644•0	2787•01 7	-1443•35 4	33•235 7	•1215 3	91•6738 1	12•92680 1	•000371 7	6•73558	28	6	1•80
36646•0	2800•65 4	-1452•40 3	33•24 1	•1218 3	92•52862 9	12•92828 1	•000376 5	6•73343	16	6	1•40
36648•0	2814•15 3	-1461•45 2	33•248 7	•1215 2	93•38671 6	12•92979 1	•000387 4	6•73490	16	6	1•29
36650•0	2827•64 4	-1470•47 2	33•235 6	•1217 1	94•24793 6	12•931415 3	•000425 2	6•73253	15	6	1•71
36652•0	2841•24 6	-1479•51 4	33•23 1	•1218 2	95•1123 1	12•93314 2	•00043 1	6•73143	16	6	3•62
36654•0	2854•70 8	-1488•55 6	33•23 2	•1218 3	95•9808 2	12•93537 4	•00056 1	6•73058	14	6	4•31
36656•0	2867• 1	-1497•61 6	33•18 7	•123 1	96•857 4	12•93762 4	•00055 3	6•72353	13	6	4•55
36658•0	2884• 3	-1506•7 2	33•1 2	•123 2	97•724 9	12•9398 1	•00056 4	6•72095	14	6	8•42
36660•0	2895•38 6	-1515•69 2	33•22 2	•1218 4	98•6119 2	12•94137 2	•00044 2	6•72836	16	6	3•05
36662•0	2908•98 4	-1524•75 2	33•22 1	•1218 3	99•4961 1	12•94326 2	•000499 7	6•72813	17	6	1•93
36664•0	2922•59 9	-1533•84 6	33•20 3	•1219 4	100•3843 3	12•94519 3	•00048 2	6•72612	12	6	2•30
36666•0	2935•75 2	-1542•89 2	33•198 6	•1218 2	101•2770 1	12•946823 8	•000475 5	6•72643	16	6	1•18
36668•0	2949•21 2	-1551•95 2	33•199 4	•1217 2	102•17256 9	12•94882 1	•000521 8	6•72645	14	6	0•95
36670•0	2962•67 1	-1561•01 1	33•200 3	•1216 1	103•07244 6	12•95112 3	•00058 1	6•72650	13	6	0•61
36672•0	2976•16 3	-1570•08 2	33•209 3	•1217 1	103•9765 1	12•953149 7	•000535 4	6•72516	11	6	0•64
36674•0	2989•61 4	-1579•15 3	33•213 5	•1216 2	104•8850 2	12•95529 1	•000547 8	6•72528	15	6	0•86
36676•0	3003•10 4	-1588•21 3	33•212 6	•1214 2	105•7977 2	12•95749 1	•000557 5	6•72597	14	6	0•87
36678•0	3016•55 9	-1597•31 2	33•220 4	•1212 2	106•7151 3	12•959711 9	•000550 5	6•72683	11	6	0•89
36680•0	3030•06 3	-1606•37 1	33•222 2	•1210 6	107•63664 9	12•961920 7	•000578 5	6•72726	21	6	1•00
36682•0	3043•58 3	-1615•43 1	33•224 2	•1208 5	108•56270 8	12•964256 4	•000630 3	6•72800	36	6	1•12
36684•0	3057•14 3	-1624•52 1	33•226 2	•1206 6	109•49362 9	12•966736 3	•000620 2	6•72922	43	6	1•36
36686•0	3070•78 4	-1633•59 2	33•230 4	•1202 8	110•4292 1	12•969205 6	•000625 4	6•73120	35	6	1•58
36688•0	3084•39 6	-1642•70 2	33•235 4	•1199 1	111•3701 2	12•971652 8	•000599 4	6•73235	39	6	1•64

ORBITAL ELEMENTS OF THE SATELLITE 1958 ALPHA
MAY - JUNE, 1959

T (MJD)	ω	Ω	i	e	M	n	n'	q	N	D	σ
36690.0	3098.05 4	-1651.806 9	33.239 3	*11982 7	112.3156 1	12.973892 4	*00516 3	6.73244	58	6	1.25
36692.0	3111.60 3	-1660.892 6	33.238 2	*11965 4	113.2656 1	12.975919 3	*00498 2	6.73004	88	6	1.06
36694.0	3125.20 4	-1669.983 7	33.241 2	*11947 5	114.2194 1	12.977871 4	*00485 2	6.73372	101	6	1.16
36696.0	3138.70 6	-1679.07 1	33.243 3	*11944 7	115.1774 2	12.979812 5	*00480 3	6.73329	92	6	1.52
36698.0	3152.41 4	-1688.185 8	33.246 2	*11930 4	116.1386 1	12.981830 4	*00532 2	6.73366	80	6	.95
36700.0	3166.04 4	-1697.30 1	33.246 3	*11934 6	117.1043 2	12.984057 6	*00579 3	6.73259	86	6	1.46
36702.0	3179.74 4	-1706.40 2	33.247 3	*11909 8	118.0745 2	12.986315 6	*00590 4	6.73374	52	6	1.45
36704.0	3193.43 5	-1715.51 2	33.245 4	*11899 9	119.0494 2	12.988703 7	*00597 4	6.73363	41	6	1.49
36706.0	3207.13 6	-1724.64 1	33.245 4	*11895 7	120.0290 2	12.991109 6	*00602 4	6.73315	31	6	1.27
36708.0	3220.60 6	-1733.74 1	33.239 4	*11916 6	121.0143 2	12.993518 6	*00600 3	6.73072	29	6	1.25
36710.0	3234.20 6	-1742.86 1	33.236 3	*11915 5	122.0038 2	12.995940 6	*00601 3	6.72994	30	6	1.27
36712.0	3247.81 8	-1751.98 2	33.233 5	*11913 6	122.9981 2	12.998361 9	*00592 5	6.72925	30	6	1.74
36714.0	3261.4 1	-1761.10 2	33.230 8	*11914 6	123.9974 3	13.00069 1	*00569 7	6.72836	25	6	1.10
36716.0	3274.9 1	-1770.25 2	33.223 1	*11909 6	125.0014 4	13.00279 1	*00498 8	6.72804	25	6	2.44
36718.0	3288.4 1	-1779.38 3	33.223 1	*11910 8	126.0092 4	13.00468 1	*00452 7	6.72733	20	6	2.21
36720.0	3302.0 1	-1788.52 3	33.221	*11905 8	127.0204 4	13.00658 1	*00487 7	6.72706	21	6	2.09
36722.0	3315.6 1	-1797.65 3	33.221	*11917 9	128.0355 4	13.00857 1	*00501 7	6.72547	18	6	1.78
36724.0	3328.9 5	-1806.75 6	33.13 4	*1187 3	129.056 1	13.01055 4	*0049 2	6.72836	21	6	7.13
36726.0	3342.8 3	-1815.95 4	33.16 3	*1187 2	130.0777 9	13.01262 3	*0055 2	6.72776	26	6	6.31
36728.0	3356.6 1	-1825.12 2	33.22 2	*1188 1	131.1046 4	13.01473 2	*0052 1	6.72640	28	6	2.97
36730.0	3370.30 7	-1834.28 1	33.22 1	*11866 8	132.1361 2	13.016931 8	*00572 6	6.72644	26	6	1.83
36732.0	3383.92 7	-1843.45 2	33.22 1	*11844 9	133.1723 2	13.019178 7	*00561 4	6.72732	24	6	1.78
36734.0	3397.58 7	-1852.61 2	33.22 1	*1183 1	134.2129 2	13.021436 6	*00569 4	6.72788	21	6	1.83
36736.0	3411.2 2	-1861.78 5	33.22 2	*1183 3	135.2581 4	13.02374 1	*00589 7	6.72677	21	6	3.80
36738.0	3424.9 2	-1870.96 6	33.22 1	*1182 3	136.3079 5	13.02607 1	*00583 8	6.72698	16	6	4.38
36740.0	3438.8 3	-1880.13 9	33.22 2	*1172 6	137.3621 8	13.02838 3	*0053 2	6.73356	15	6	7.67
36742.0	3452.43 6	-1889.34 3	33.225 6	*1172 2	138.4212 2	13.030535 8	*00545 4	6.73264	15	6	2.42
36744.0	3466.15 4	-1898.50 2	33.223 4	*1170 1	139.4845 1	13.032649 8	*00515 4	6.73345	25	6	2.11
36746.0	3479.95 2	-1907.66 1	33.218 3	*1171 1	140.55159 9	13.034672 4	*00511 2	6.73222	22	6	1.11
36748.0	3493.72 2	-1916.84 1	33.221 3	*1171 8	141.62290 7	13.036748 4	*00535 3	6.73145	32	6	1.05

ORBITAL ELEMENTS OF THE SATELLITE 1958 ALPHA
JULY - AUGUST, 1959

(MJD)	ω	Ω	i	e	M	n	n'	q	N	D	σ
36750.0	3507.51 2	-1925.99 2	33.228 5	*1172 1	142.6983	1	13.03883	1	*000511 6	6.73001	21 6 1.15
36752.0	3521.22 3	-1935.25 2	33.208 7	*1167 1	143.7782	1	13.04050	1	*000412 6	6.73323	22 6 1.62
36754.0	3535.11 6	-1944.46 2	33.224 7	*1170 2	144.8605	2	13.04222	1	*000428 6	6.73064	22 6 1.73
36756.0	3548.81 2	-1953.646 8	33.221 4	*11674 9	145.94690	7	13.043965	5	*000438 3	6.73179	35 6 1.37
36758.0	3562.59 2	-1962.842 7	33.225 3	*11664 8	147.03655	6	13.045753	4	*000455 2	6.73190	54 6 1.51
36760.0	3576.35 2	-1972.042 7	33.225 3	*11657 8	148.12995	5	13.047665	5	*000485 3	6.73180	40 6 1.26
36762.0	3590.12 1	-1981.247 6	33.224 2	*11661 6	149.22725	5	13.049749	2	*000521 2	6.73081	36 6 *96
36764.0	3604.0 2	-1990.44 9	33.23 2	*1163 6	150.3285	7	13.05199	4	*00067 3	6.73216	27 6 9.50
36766.0	3617.64 3	-1999.66 1	33.222 3	*11667 8	151.4353	1	13.054604	3	*000655 2	6.72865	25 6 1.17
36768.0	3631.36 9	-2008.86 4	33.23 1	*1170 3	152.5473	3	13.05713	2	*00059 1	6.72549	24 6 4.06
36770.0	3645.16 8	-2018.07 4	33.24 1	*1170 3	153.6637	3	13.05938	1	*000531 8	6.72459	23 6 3.73
36772.0	3658.81 2	-2027.31 2	33.228 7	*1168 1	154.7850	1	13.061429	5	*000476 3	6.72572	19 6 1.14
36774.0	3672.51 1	-2036.53 2	33.231 6	*1168 1	155.90978	7	13.063332	6	*000471 4	6.72502	13 6 *49
36776.0	3686.20 3	-2045.74 2	33.231 4	*1167 1	157.03833	8	13.065200	7	*000467 7	6.72445	11 6 *72
36778.0	3700.0 2	-2055.1 2	33.23 3	*1153 7	158.1710	3	13.06695	8	*00044 2	6.73464	20 6 7.30
36780.0	3713.60 4	-2064.23 3	33.241 8	*1164 2	159.30664	8	13.06871	2	*00038 1	6.72579	21 6 1.69
36782.0	3727.2 1	-2073.48 8	33.24 2	*1159 4	160.44662	3	13.07043	2	*00042 1	6.72940	27 6 4.69
36784.0	3741.4 6	-2082.68 5	33.23 2	*1166 7	161.587 1	1	13.07213	1	*000424 6	6.72327	19 6 1.49
36786.0	3754.7 5	-2091.88 4	33.22 2	*1158 8	162.734	2	13.073865	8	*000445 5	6.72868	20 6 1.45
36788.0	3768.4 3	-2101.14 3	33.23 2	*1153 6	163.885	1	13.075639	8	*000440 5	6.73199	17 6 1.00
36790.0	3783.0 2	-2110.4 1	33.25 9	117 3	165.033	6	13.07748	4	*00044 2	6.71585	16 6 4.83
36792.0	3796. 3	-2119.7 2	33.3 2	*113 5	166.19	1	13.07880	9	*00031 8	6.74450	10 6 7.75
36794.0	3810. 4	-2128.9 2	33.1 3	*115 7	167.35	1	13.08042	9	*00041 7	6.73546	8 6 9.34
36796.0	3823.9 2	-2138.19 6	33.22 2	*1150 3	168.5149	6	13.08213	7	*00037 2	6.73176	8 6 4.12
36798.0	3837.7 1	-2147.46 5	33.22 2	*1151 2	169.6807	2	13.08364	2	*00039 1	6.73061	9 6 3.14
36800.0	3851.71 9	-2156.73 5	33.22 2	*1150 1	170.8493	2	13.08515	1	*00036 1	6.73119	9 6 2.96
36802.0	3865.9 2	-2165.9 1	33.34 6	*1138 5	172.0203	5	13.08661	6	*00040 2	6.73958	9 6 5.28
36804.0	3879.6 3	-2175.2 1	33.27 5	*1142 5	173.1952	7	13.08813	4	*00038 3	6.73571	10 6 5.25
36806.0	3893.3 1	-2184.47 2	33.230 5	*1144 2	174.3736	3	13.08974	3	*000397 7	6.73382	13 6 1.66
36808.0	3907.2 1	-2193.74 2	33.229 5	*1144 2	175.5547	3	13.09131	2	*00036 2	6.73316	12 6 1.57
36810.0	3921.16 8	-2203.02 2	33.227 5	*1143 1	176.7387	2	13.092965	7	*000416 6	6.73343	12 6 1.74

ORBITAL ELEMENTS OF THE SATELLITE 1958 ALPHA
SEPTEMBER - OCTOBER, 1959

T (MJD)	ω	Ω	i	e	M	n	n'	q	N	D	σ
36812.0	3935.20 5	-2212.25 2	33.219 3	*1144 1	177.9257 2	13.09480 1	.000477 4	6.73228	8	6	.67
36814.0	3948.94 4	-2221.565 9	33.222 3	*11468 6	179.1176 1	13.096744 9	.000505 6	6.72933	20	6	.97
36816.0	3962.70 5	-2230.85 1	33.227 4	*11489 8	180.3133 1	13.098705 6	.000472 4	6.72704	28	6	1.03
36818.0	3976.56 5	-2240.13 1	33.227 5	*11517 8	181.5126 1	13.100413 5	.000388 4	6.72432	31	6	1.23
36820.0	3990.28 5	-2249.34 3	33.21 1	*1140 6	182.7155 2	13.101881 6	.000355 4	6.73234	21	6	.76
36822.0	4004.19 5	-2258.65 4	33.22 2	*112 1	183.9211 3	13.103306 6	.000352 4	6.74560	9	6	.70
36824.0	4017.66 8	-2267.93 3	33.19 2	*120 2	185.1276 6	13.10472 1	.000349 6	6.68588	8	6	1.26
36826.0	4029.6 6	-2277.0 1	33.8 3	*126 9	186.341 3	13.1061 1	.00034 5	6.63891	8	6	7.76
36828.0	4045.45 7	-2286.55 2	33.20 1	*11492 9	187.5534 2	13.10756 1	.000360 7	6.72377	14	6	2.22
36830.0	4059.29 6	-2295.84 3	33.21 1	*11484 7	188.7700 1	13.109080 9	.000399 6	6.72390	15	6	1.97
36832.0	4073.07 7	-2305.12 3	33.21 1	*11478 6	189.9898 1	13.110732 9	.000426 5	6.72380	19	6	1.67
36834.0	4086.96 9	-2314.40 2	33.220 3	*11453 8	191.2127 2	13.112387 8	.000414 4	6.72510	23	6	1.95
36836.0	4100.73 9	-2323.68 2	33.222 4	*11444 7	192.4393 2	13.114043 8	.000425 5	6.72525	28	6	2.34
36838.0	4114.60 9	-2333.00 3	33.224 4	*11431 7	193.6690 2	13.115690 8	.000411 4	6.72565	26	6	2.46
36840.0	4128.62 5	-2342.32 2	33.223 3	*11409 3	194.9017 1	13.117172 3	.000366 2	6.72683	24	6	1.38
36842.0	4142.4 1	-2351.60 4	33.229 7	*11402 7	196.1375 3	13.118596 7	.000363 3	6.72689	23	6	3.25
36844.0	4156.6 1	-2360.92 3	33.219 9	*11376 6	197.3757 3	13.120076 7	.000376 3	6.72831	22	6	3.28
36846.0	4170.5 2	-2370.22 4	33.22 2	*1135 1	198.6175 6	13.121496 9	.000345 5	6.72956	18	6	4.49
36848.0	4184.2 8	-2379.5 1	33.23 5	*1132 2	199.8624 2	13.12277 4	.00030 2	6.73138	14	6	12.25
36850.0	4198.0 9	-2388.8 1	33.23 7	*1132 3	201.109 2	13.12397 7	.00031 4	6.73138	12	6	13.26
36852.0											
36864.0											
36866.0	4309.76 8	-2463.43 3	33.238 9	*11316 6	211.1577 2	13.133024 8	.000328 7	6.72847	18	6	2.18
36868.0	4323.70 8	-2472.76 3	33.238 9	*11299 6	212.4250 2	13.13432 1	.000331 6	6.72928	19	6	2.17
36870.0	4337.68 9	-2482.08 3	33.227 6	*11335 7	213.6946 2	13.135497 7	.000321 5	6.72618	29	6	2.78
36872.0	4351.58 7	-2491.39 2	33.222 5	*11363 6	214.9669 2	13.136883 5	.000352 3	6.72356	32	6	2.86

ORBITAL ELEMENTS OF THE SATELLITE 1958 ALPHA
NOVEMBER - DECEMBER, 1959

T (MJD)	ω	Ω	i	e	M	n	n'	q	N	D	σ
36874.0	4365.437	-2500.722	33.2176	•113535	216.2423	2	13.138270	6	•0003663	3	6.72383
36876.0	4379.427	-2510.052	33.2176	•113415	217.5203	2	13.139720	6	•0003653	3	6.72430
36878.0	4393.436	-2519.402	33.2195	•113395	218.8010	1	13.141061	1	•0003367	7	6.72395
36880.0	4407.41	-2528.765	33.222	•11341	220.0844	4	13.14242	2	•000336	6	6.72335
36882.0											
36886.0	4463.47	-2566.149	33.236	•1084	225.2343	3	13.146243	3	•000282	2	6.76463
36890.0	4477.94	-2575.526	33.244	•1042	226.5252	2	13.147383	3	•000281	1	6.79028
36892.0	4490.71	-2584.842	33.2136	•11236	227.82665	5	13.1485823	3	•0002852	2	6.72970
36894.0	4504.71	-2594.182	33.2146	•11207	229.12455	5	13.1497476	6	•0002882	2	6.73161
36896.0	4518.607	-2603.542	33.2174	•11222	230.42553	3	13.1509754	4	•0002982	2	6.72956
36898.0	4532.563	-2612.901	33.2152	•111859	231.728505	5	13.1522163	3	•0003081	1	6.73187
36900.0	4546.553	-2622.281	33.2172	•112229	233.034076	6	13.1534874	4	•0003302	2	6.72860
36902.0	4560.533	-2631.6469	33.2202	•112359	234.342256	6	13.1548003	3	•0003242	2	6.72718
36904.0	4574.402	-2640.9977	33.22212	•112218	235.653297	7	13.1561223	3	•0003272	2	6.72780
36906.0	4588.661	-2650.3608	33.22213	•111758	236.965583	3	13.1574363	3	•0003321	1	6.73080
36908.0	4602.601	-2659.7256	33.22212	•111728	238.281762	2	13.1587574	4	•0003272	2	6.73056
36910.0	4616.542	-2669.0787	33.22134	•11201	239.600474	4	13.1599445	5	•0002983	3	6.72833
36912.0	4630.52	-2678.466	33.243	•1101	240.92094	4	13.161114	4	•000272	2	6.74437
36914.0	4644.865	-2687.822	33.22246	•11232	242.243729	1	13.1622947	7	•0002853	3	6.72504
36916.0	4658.805	-2697.201	33.22234	•11192	243.56941	1	13.1634226	6	•0002913	3	6.72742
36918.0	4672.755	-2706.612	33.2127	•11152	244.89751	1	13.1645467	7	•0002804	4	6.73041
36920.0	4686.795	-2715.962	33.2177	•11152	246.22751	1	13.165611	1	•0002648	8	6.72988
36922.0	4704.4	-2726.05	33.298	•102	247.552	2	13.16641	1	•000226	6	6.80195
36924.0	4714.685	-2734.6956	33.2191	•11223	248.89402	2	13.1672877	7	•0002052	2	6.72391
36926.0	4728.73	-2744.073	33.2207	•11207	250.2291	1	13.168291	1	•0003055	5	6.72560
36928.0	4742.73	-2753.474	33.221	•11178	251.5671	1	13.169521	1	•0003163	3	6.72706
36930.0	4756.624	-2762.846	33.222	•1131	252.9102	1	13.170781	1	•0002988	8	6.71896
36932.0	4770.33	-2772.236	33.222	•11255	254.25246	1	13.171931	1	•0002856	6	6.71994

ORBITAL ELEMENTS OF THE SATELLITE 1958 ALPHA
JANUARY - FEBRUARY, 1960

T (MJD)	ω	Ω	i	e	M	n	n'	q	N	D	σ
36934.0	4784.9 2	-2782.0 1	33.41 5	.1109 9	255.5965 2	13.17320 3	.00031 1	6.73205	16	6	4.69
36936.0	4798.9 2	-2791.6 1	33.50 5	.1126 8	256.9446 2	13.17453 3	.00038 2	6.71854	9	6	5.62
36938.0	4813.1 1	-2800.97 9	33.55 3	.1136 6	258.2945 4	13.17625 5	.00047 4	6.71057	6	6	3.53
36940.0	4826.5 3	-2809.79 3	33.23 3	.1117 2	259.6490 5	13.17786 4	.00044 5	6.72401	4	6	1.03
36942.0	4840.63 8	-2819.15 3	33.20 3	.1115 3	261.0062 2	13.17951 1	.398E-3 8	6.72519	8	10	2.38
36944.0	4857.1	-2828.50 5	33.33 9	.1110 5	262.360 4	13.18116 5	.00034 2	6.72851	5	6	1.39
36946.0	4870.2	-2838.0 1	33.2 1	.1098 8	263.727 8	13.18260 6	.00035 2	6.73714	17	6	5.47
36948.0	4882.53 4	-2847.33 1	33.25 1	.1106 1	265.0977 1	13.183991 9	.000352 4	6.73085	38	6	1.40
36950.0	4896.54 2	-2856.746 9	33.234 5	.11047 7	266.46709 7	13.185407 4	.000345 2	6.73097	60	6	1.10
36952.0	4910.54 2	-2866.15 1	33.232 5	.11044 7	267.83926 6	13.186796 4	.000343 2	6.73073	67	6	1.12
36954.0	4924.51 3	-2875.56 1	33.228 5	.11034 8	269.2143 9	13.188228 4	.000360 2	6.73100	65	6	1.36
36956.0	4938.98 4	-2885.00 2	33.217 5	.11040 9	270.5905 1	13.189760 4	.000395 2	6.73001	52	6	1.30
36958.0	4953.06 6	-2894.39 2	33.224 6	.1101 1	271.9712 2	13.191439 6	.000433 3	6.73200	46	6	2.11
36960.0	4967.0 1	-2903.85 4	33.215 8	.1106 2	273.3557 3	13.19336 1	.000498 4	6.72751	54	6	3.88
36962.0	4980.99 6	-2913.26 2	33.218 5	.1104 1	274.7444 2	13.195385 5	.000546 2	6.72777	58	6	2.67
36964.0	4995.05 8	-2922.70 2	33.215 6	.1104 1	276.1372 2	13.197637 6	.000580 3	6.72766	57	6	3.39
36966.0	5009.33 6	-2932.10 1	33.217 3	.11007 7	277.5338 2	13.200009 6	.0628E-3 4	6.72907	56	6	1.64
36968.0	5023.36 6	-2941.52 1	33.213 4	.11010 7	278.9363 2	13.202551 5	.0650E-3 3	6.72796	50	6	1.72
36970.0	5037.73 6	-2950.93 1	33.210 4	.10977 6	280.3429 2	13.205075 6	.0605E-3 4	6.72955	39	6	1.47
36972.0	5051.65 8	-2960.38 2	33.202 6	.11006 7	281.7558 2	13.207192 8	.496E-3 6	6.72668	31	6	1.97
36974.0	5065.73 7	-2969.81 2	33.196 5	.10999 6	283.1721 2	13.20894 1	.432E-3 6	6.72658	21	6	1.59
36976.0	5079.80 9	-2979.27 2	33.193 5	.10998 6	284.5918 3	13.210599 9	.411E-3 5	6.72612	16	6	1.43
36978.0	5093.9 1	-2988.74 2	33.193 6	.1102 1	286.0147 4	13.21213 1	.383E-3 5	6.72376	12	6	1.29
36980.0	5107.9 1	-2998.18 1	33.197 4	.11024 7	287.4408 3	13.213598 9	.366E-3 4	6.72310	17	6	0.96
36982.0	5122.07 8	-3007.65 1	33.196 4	.11006 5	288.8693 3	13.215101 6	.405E-3 4	6.72395	24	6	0.86
36984.0	5136.08 6	-3017.07 1	33.200 3	.10999 5	290.3015 2	13.216700 6	.398E-3 4	6.72399	32	6	0.97
36986.0	5150.13 6	-3026.55 1	33.197 4	.10980 5	291.7368 2	13.218291 6	.395E-3 4	6.72486	34	6	1.24
36988.0	5164.22 5	-3036.04 1	33.195 3	.10969 4	293.1751 1	13.219857 5	.388E-3 3	6.72515	30	6	1.08
36990.0	5178.33 5	-3045.48 1	33.201 4	.10961 4	294.6164 1	13.221489 7	.420E-3 5	6.72524	25	6	1.10
36992.0	5192.43 5	-3045.91 1	33.209 4	.10958 4	296.0613 1	13.223512 6	.519E-3 3	6.72479	17	6	0.89

ORBITAL ELEMENTS OF THE SATELLITE 1958 ALPHA

MARCH - APRIL, 1960

T (MD)	ω	Ω	i	e	M	n	n'	q	N	D	σ
36994.0	5206.54 8	-3064.40 2	33.209 6	*10912 5	297.5103 2	13.225507 7	*485E-3 6	6.72756	22	6	1.73
36996.0	5220.60 7	-3073.87 2	33.214 4	*10893 3	298.9635 2	13.227486 8	*472E-3 5	6.72830	23	6	1.38
36998.0	5234.74 9	-3083.33 2	33.213 5	*10893 4	300.4201 3	13.22944 1	*500E-3 8	6.72764	24	6	1.82
37000.0	5248.9 1	-3092.79 3	33.215 6	*10879 6	301.8809 4	13.23146 2	*50E-3 1	6.72805	12	6	1.62
37002.0	5263.2 1	-3102.27 3	33.223 9	*1084 1	303.3446 3	13.23321 1	*44E-3 1	6.73018	19	6	1.88
37004.0	5277.3 1	-3111.79 4	33.226 1	*1084 1	304.8129 3	13.23514 2	*505E-3 9	6.72956	23	6	2.06
37006.0	5291.5 2	-3121.26 4	33.226 2	*1084 2	306.2844 5	13.23689 2	*44E-3 1	6.72905	18	6	2.61
37008.0	5305.73 7	-3130.70 1	33.224 5	*10815 7	307.7594 2	13.238565 6	*408E-3 5	6.73047	18	6	.77
37010.0	5320.00 7	-3140.201 9	33.235 5	*10813 7	308.2376 2	13.240303 7	*462E-3 6	6.72999	19	6	1.07
37012.0	5324.19 7	-3149.76 1	33.234 6	*10810 8	310.7195 2	13.242125 7	*456E-3 5	6.72965	24	6	1.51
37014.0	5348.4 1	-3159.15 2	33.23 1	*1079 1	312.2052 3	13.24398 1	*464E-3 8	6.73058	28	6	2.69
37016.0	5362.5 1	-3168.62 2	33.223 1	*1077 2	313.6949 3	13.24589 1	*487E-3 8	6.73115	30	6	2.68
37018.0	5376.86 5	-3178.14 1	33.231 6	*10804 8	315.1878 2	13.247985 7	*539E-3 4	6.72809	27	6	1.33
37020.0	5391.12 4	-3187.65 1	33.222 3	*10823 5	316.6854 1	13.250252 4	*582E-3 3	6.72586	38	6	.85
37022.0	5405.24 3	-3197.130 9	33.227 3	*10805 5	318.1881 1	13.252632 5	*616E-3 2	6.72645	53	6	.87
37024.0	5419.34 3	-3206.631 8	33.227 3	*10796 5	319.69595 9	13.2551=9 6	*671E-3 5	6.72627	53	6	.72
37026.0	5433.61 5	-3216.15 2	33.216 5	*1079 1	321.2088 2	13.257920 7	*674E-3 4	6.72588	58	6	1.87
37028.0	5447.76 3	-3225.66 1	33.213 3	*10813 6	322.7275 8	13.260331 4	*501E-3 3	6.72325	52	6	1.32
37030.0	5461.89 2	-3235.16 2	33.211 2	*10802 4	324.25027 6	13.262367 5	*531E-3 3	6.72334	47	6	.93
37032.0	5476.09 2	-3244.71 1	33.206 3	*10796 6	325.77720 7	13.264400 5	*515E-3 2	6.72317	37	6	.92
37034.0	5490.28 3	-3254.23 2	33.205 3	*10785 8	327.30823 9	13.266456 5	*510E-3 2	6.72324	28	6	.90
37036.0	5504.3 4	-3263.76 3	33.206 3	*1078 2	328.844 1	13.268465 .9	*505E-3 3	6.72281	17	6	.77
37038.0	5518.5 3	-3273.36 3	33.213 6	*1078 2	330.383 1	13.270513 6	*520E-3 3	6.72205	18	8	1.15
37040.0	5533.6 4	-3282.92 2	33.226 9	*1080 2	331.923 1	13.272604 6	*553E-3 2	6.72003	15	8	.67
37042.0	5546.90 4	-3292.44 2	33.224 6	*1073 1	333.4744 1	13.274791 8	*552E-3 3	6.72451	19	8	.93
37044.0	5561.06 4	-3301.94 2	33.215 9	*1069 2	335.0266 1	13.27690 1	*523E-3 4	6.72668	19	8	1.17
37046.0	5575.38 4	-3311.44 2	33.20 1	*1065 2	336.58249 9	13.278963 9	*514E-3 3	6.72923	14	8	1.17
37048.0	5589.7 2	-3320.91 8	33.22 4	*1061 7	338.1425 3	13.28101 2	*52E-3 1	6.73185	11	8	4.34
37050.0	5604.3 3	-3330.1 2	33.31 5	*1051 5	339.7055 7	13.28306 4	*47E-3 2	6.73849	7	8	4.78
37052.0	5618.0 1	-3340.13 9	33.19 3	*1065 4	341.2758 3	13.2848= 2	*438E-3 8	6.72699	9	8	4.89
37054.0	5632.42 7	-3349.68 5	33.22 1	*1060 2	342.8475 2	13.28655 2	*404E-3 4	6.73025	14	8	3.60

TABLE 2

Data related to the solar effects on the
acceleration of Satellite 1958 Alpha

MJD	-P	Z	φ	D.R.A.	Ψ
PERIGEE IN EARTH SHADOW					
36240.	0.548E-05	355.	15.40	158.65	159.44
36242.	0.558E-05	357.	8.84	159.27	158.76
36244.	0.569E-05	357.	1.98	159.53	156.18
36246.	0.535E-05	358.	-4.96	159.74	152.42
36248.	0.420E-05	358.	-11.73	160.22	148.23
36250.	0.365E-05	361.	-18.06	161.14	144.15
36252.	0.547E-05	361.	-23.57	162.57	140.66
36254.	0.456E-05	362.	-28.23	165.44	138.16
36256.	0.459E-05	365.	-31.55	169.49	136.81
36258.	0.444E-05	367.	-33.13	174.11	136.79
36260.	0.466E-05	366.	-32.87	178.91	138.14
36262.	0.454E-05	365.	-30.82	183.32	140.81
36264.	0.462E-05	364.	-27.19	186.90	144.70
36266.	0.484E-05	362.	-22.34	189.46	149.50
36268.	0.536E-05	360.	-16.44	191.05	155.09
36270.	0.451E-05	358.	-9.95	191.93	160.77
36272.	0.478E-05	357.	-3.11	192.35	165.56
36274.	0.509E-05	356.	3.81	192.57	167.46
36276.	0.548E-05	356.	10.62	193.04	164.88
36278.	0.496E-05	356.	17.06	193.98	159.64
36280.	0.556E-05	356.	22.83	195.71	153.56
36282.	0.564E-05	357.	27.60	198.35	147.64
36284.	0.581E-05	357.	31.06	201.98	142.30
36286.	0.604E-05	359.	32.92	206.47	137.77
36288.	0.665E-05	361.	33.00	211.33	134.24
36290.	0.577E-05	360.	31.28	215.81	131.90
36292.	0.652E-05	360.	27.95	219.52	130.66
36294.	0.835E-05	356.	23.29	222.06	130.59
36296.	0.670E-05	356.	17.52	223.80	131.24
36298.	0.708E-05	351.	11.12	224.87	132.25
36300.	0.668E-05	349.	4.32	225.57	133.23
36302.	0.553E-05	355.	-2.65	225.84	134.12
36304.	0.465E-05	358.	-9.49	226.25	134.30
36306.	0.453E-05	359.	-16.05	227.12	133.51
36308.	0.483E-05	360.	-22.00	228.81	131.62
36310.	0.606E-05	363.	-26.97	231.27	128.99
36312.	0.575E-05	364.	-30.69	234.85	125.65
36314.	0.579E-05	366.	-32.82	239.26	122.00
36316.	0.579E-05	366.	-33.14	244.11	118.27
36318.	0.635E-05	365.	-31.60	248.76	114.72
36320.	0.633E-05	364.	-28.36	252.68	111.49

MJD	-P	Z	φ	D.R.A.	Ψ
PERIGEE IN SUNLIGHT					
36322.	0.664E-05	362.	-23.77	255.51	108.73
36324.	0.636E-05	360.	-18.07	257.33	106.33
36326.	0.501E-05	358.	-11.66	258.33	104.17
36328.	0.508E-05	356.	-4.81	258.90	101.98
36330.	0.517E-05	355.	2.18	259.05	99.85
36332.	0.512E-05	355.	9.10	259.30	97.38
36334.	0.489E-05	355.	15.69	260.02	94.40
36336.	0.513E-05	356.	21.68	261.43	90.92
36338.	0.522E-05	356.	26.74	263.80	86.97
36340.	0.519E-05	357.	30.51	267.11	82.78
36342.	0.544E-05	358.	32.74	271.30	78.50
36344.	0.515E-05	358.	33.16	275.95	74.40
36346.	0.539E-05	357.	31.74	280.37	70.91
36390.	0.569E-05	356.	15.63	321.55	36.90
36392.	0.659E-05	358.	21.70	322.91	34.28
36394.	0.649E-05	361.	26.82	325.28	31.79
36396.	0.511E-05	355.	30.51	328.16	29.65
36398.	0.274E-05	357.	32.72	332.74	26.48
36400.	0.470E-05	356.	33.13	337.10	23.37
36402.	0.482E-05	360.	31.62	341.97	19.20
36404.	0.489E-05	360.	28.36	345.80	14.95
36406.	0.523E-05	360.	23.68	348.63	11.02
36408.	0.548E-05	355.	18.81	348.82	10.61
36412.	0.640E-05	355.	4.86	351.37	16.59
36414.	0.709E-05	356.	-2.21	351.57	22.49
36416.	0.724E-05	358.	-9.22	351.92	28.57
36418.	0.695E-05	359.	-15.96	352.85	34.40
36420.	0.721E-05	363.	-22.20	354.92	39.69
36422.	0.589E-05	363.	-27.08	357.04	43.80
36424.	0.601E-05	365.	-30.78	0.54	46.85
36426.	0.600E-05	366.	-32.87	5.09	48.60
36428.	0.598E-05	366.	-33.08	10.01	48.92
36430.	0.609E-05	365.	-31.40	14.66	47.81
36432.	0.649E-05	363.	-27.96	18.69	45.39
36434.	0.666E-05	362.	-23.15	21.50	41.85
36436.	0.683E-05	360.	-17.25	23.40	37.56
36438.	0.808E-05	359.	-10.66	24.41	32.99
36440.	0.867E-05	357.	-3.72	24.86	28.80
36442.	0.102E-04	355.	3.40	25.21	25.95
36444.	0.977E-05	355.	10.45	26.01	25.62
36446.	0.920E-05	356.	17.05	26.83	27.35
36448.	0.985E-05	357.	22.92	28.56	31.11
36450.	0.103E-04	356.	27.83	31.43	36.02
36452.	0.100E-04	358.	31.29	35.28	41.10
36454.	0.926E-05	359.	33.05	39.85	45.83
36456.	0.944E-05	361.	32.95	44.70	49.95
36458.	0.995E-05	359.	30.94	49.51	53.47
36460.	0.101E-04	360.	27.28	53.28	55.95
36462.	0.107E-04	355.	22.22	56.01	57.58
36464.	0.100E-04	357.	16.19	57.70	58.45
36466.	0.897E-05	355.	9.53	58.60	58.82

MJD	\hat{P}	Z	ψ	D.R.A.	ψ
36468.	0.861E-05	355.	2.46	59.10	59.11
36470.	0.862E-05	355.	-4.70	59.50	59.60
36472.	0.953E-05	356.	-11.71	60.16	60.63
36474.	0.958E-05	359.	-18.18	61.12	62.09
36476.	0.919E-05	360.	-24.08	63.53	64.89
36478.	0.937E-05	363.	-28.50	65.87	67.29
36480.	0.883E-05	366.	-31.98	71.60	72.27
36482.	0.895E-05	370.	-33.20	75.42	75.17
36484.	0.772E-05	364.	-32.60	80.64	79.11
36486.	0.749E-05	360.	-30.02	85.57	83.00
36488.	0.792E-05	355.	-25.70	89.53	86.50
36490.	0.793E-05	361.	-20.54	91.22	88.38
36492.	0.885E-05	353.	-13.90	93.25	91.06
36494.	0.906E-05	354.	-7.24	93.56	92.31

PERIGEE IN EARTH SHADOW

36516.	0.682E-05	339.	24.34	122.23	125.71
36518.	0.690E-05	350.	18.47	124.65	127.51
36520.	0.620E-05	354.	11.96	125.67	127.33
36574.	0.519E-05	336.	11.90	186.45	167.65
36576.	0.600E-05	341.	5.06	186.20	161.68
36578.	0.626E-05	353.	-2.14	186.02	155.06
36580.	0.520E-05	354.	-9.42	186.31	148.17
36582.	0.462E-05	356.	-16.33	187.08	141.57
36584.	0.421E-05	359.	-22.48	188.67	135.59
36586.	0.425E-05	360.	-27.57	191.24	130.49
36588.	0.410E-05	360.	-31.23	194.93	126.49
36606.	0.465E-05	352.	6.53	217.87	141.81
36608.	0.471E-05	351.	13.60	218.49	142.72
36610.	0.473E-05	352.	20.07	219.76	141.68
36612.	0.465E-05	353.	25.64	222.01	138.86
36614.	0.478E-05	353.	29.92	225.37	134.87
36616.	0.486E-05	353.	32.53	229.79	130.28
36618.	0.505E-05	353.	33.21	234.66	125.75
36620.	0.600E-05	347.	32.19	237.48	123.20
36622.	0.408E-05	353.	28.60	243.88	117.72
36624.	0.492E-05	380.	23.67	247.44	114.36
36626.	0.560E-05	393.	17.56	249.52	112.04
36628.	0.508E-05	356.	11.12	250.07	110.98
36630.	0.474E-05	351.	3.99	250.51	109.81
36632.	0.433E-05	346.	-3.28	250.79	108.66

PERIGEE IN SUNLIGHT

36634.	0.440E-05	358.	-10.75	251.74	106.74
36636.	0.440E-05	357.	-17.51	252.80	104.80
36638.	0.412E-05	357.	-23.47	254.66	102.34
36640.	0.433E-05	360.	-28.35	257.74	99.16
36642.	0.431E-05	363.	-31.71	262.00	95.46
36644.	0.444E-05	364.	-33.18	267.06	91.52
36646.	0.450E-05	361.	-32.60	272.43	87.45
36648.	0.463E-05	362.	-30.02	277.08	83.80
36650.	0.508E-05	358.	-25.72	280.72	80.64
36652.	0.514E-05	356.	-20.06	283.30	78.03

MJD	\dot{P}	Z	Ψ	D.R.A.	Ψ
36654.	0.669E-05	353.	-13.54	284.75	76.22
36656.	0.657E-05	345.	-7.07	284.51	76.01
36658.	0.669E-05	343.	2.18	287.88	72.02
36660.	0.525E-05	350.	8.35	286.68	72.86
36662.	0.596E-05	351.	15.39	287.70	71.55
36664.	0.573E-05	351.	21.75	289.49	69.67
36666.	0.567E-05	352.	26.91	291.91	67.40
36668.	0.621E-05	354.	30.79	295.75	64.05
36670.	0.692E-05	354.	32.89	300.52	59.96
36672.	0.638E-05	353.	32.99	305.70	55.32
36674.	0.652E-05	353.	31.06	310.50	50.52
36676.	0.664E-05	352.	27.31	314.44	45.95
36678.	0.655E-05	351.	22.13	317.16	42.32
36680.	0.688E-05	350.	15.87	318.91	40.03
36682.	0.750E-05	350.	8.91	319.85	39.58
36684.	0.737E-05	351.	1.57	320.34	40.93
36686.	0.743E-05	353.	-5.88	320.82	43.60
36688.	0.712E-05	355.	-13.08	321.54	47.01
36690.	0.613E-05	357.	-19.75	322.97	50.39
36692.	0.592E-05	356.	-25.44	325.30	53.23
36694.	0.576E-05	361.	-29.84	328.82	55.04
36696.	0.570E-05	361.	-32.52	333.28	55.57
36698.	0.631E-05	362.	-33.21	338.55	54.57
36700.	0.687E-05	360.	-31.80	343.57	52.12
36702.	0.700E-05	360.	-28.43	347.87	48.27
36704.	0.708E-05	359.	-23.46	351.00	43.24
36706.	0.713E-05	357.	-17.31	352.96	37.29
36708.	0.711E-05	353.	-10.49	353.84	30.87
36710.	0.712E-05	352.	-3.18	354.28	24.03
36712.	0.701E-05	351.	4.27	354.55	17.15
36714.	0.673E-05	351.	11.53	355.02	10.56
36716.	0.589E-05	352.	18.27	355.96	4.86
36718.	0.535E-05	353.	24.19	357.83	3.25
36720.	0.576E-05	354.	28.93	0.92	7.06
36722.	0.592E-05	353.	32.05	5.12	10.85
36724.	0.579E-05	356.	33.12	9.71	13.70
36726.	0.650E-05	355.	32.23	14.95	16.33
36728.	0.614E-05	353.	29.33	19.44	18.59
36730.	0.675E-05	352.	24.70	22.70	20.80
36732.	0.662E-05	351.	18.82	24.70	23.43
36734.	0.671E-05	350.	12.06	25.79	26.94
36736.	0.695E-05	349.	4.81	26.20	31.34
36738.	0.687E-05	349.	-2.68	26.42	36.65
36740.	0.624E-05	356.	-10.17	26.97	42.72
36742.	0.642E-05	356.	-17.09	27.77	48.77
36744.	0.606E-05	358.	-23.27	29.59	54.83
36746.	0.602E-05	359.	-28.31	32.64	60.49
36748.	0.630E-05	359.	-31.73	36.81	65.31
36750.	0.601E-05	358.	-33.19	41.85	69.05
36752.	0.485E-05	361.	-32.49	46.84	71.30
36754.	0.503E-05	358.	-29.74	51.49	72.23
36756.	0.515E-05	357.	-25.27	54.86	71.61

MJD	-P	Z	ψ	D.R.A.	ψ
36758.	0.535E-05	356.	-19.44	57.12	69.77
36760.	0.570E-05	354.	-12.70	58.37	67.02
36762.	0.612E-05	353.	-5.39	58.96	63.84
36764.	0.787E-05	354.	2.19	59.37	60.84
36766.	0.769E-05	351.	9.56	59.68	58.39
36768.	0.692E-05	349.	16.57	60.58	57.19
36770.	0.623E-05	349.	22.87	62.42	57.57
36772.	0.558E-05	352.	27.95	65.22	59.35
36774.	0.552E-05	352.	31.51	69.27	62.52
36776.	0.547E-05	352.	33.15	74.18	66.60
36778.	0.515E-05	363.	32.66	79.30	71.13
36780.	0.445E-05	353.	30.15	83.89	75.71
36782.	0.492E-05	355.	25.89	87.34	79.93
36784.	0.496E-05	347.	19.99	90.24	84.32
36786.	0.521E-05	351.	13.54	91.27	87.27
36788.	0.515E-05	354.	6.33	91.93	90.06
36790.	0.515E-05	337.	-1.64	93.02	93.35
36792.	0.362E-05	367.	-8.70	92.79	94.95
36794.	0.479E-05	359.	-15.85	94.03	97.74
36796.	0.432E-05	356.	-22.33	95.89	100.62
36798.	0.456E-05	357.	-27.59	98.84	103.88
36800.	0.421E-05	359.	-31.34	103.23	107.79

PERIGEE IN EARTH SHADOW

36802.	0.467E-05	368.	-33.24	108.86	112.29
36804.	0.444E-05	364.	-32.75	114.05	116.31
36806.	0.463E-05	361.	-30.22	118.75	120.15
36808.	0.420E-05	359.	-25.88	122.63	123.64
36810.	0.485E-05	358.	-20.10	125.34	126.29
36812.	0.556E-05	355.	-13.28	127.12	127.97
36814.	0.589E-05	351.	-6.03	127.84	128.22
36816.	0.550E-05	349.	1.48	128.29	127.69
36818.	0.452E-05	346.	8.99	128.92	126.80
36820.	0.414E-05	356.	16.03	129.97	125.95
36822.	0.410E-05	370.	22.45	131.95	125.64
36824.	0.406E-05	312.	27.55	134.64	125.99
36826.	0.396E-05	266.	31.43	136.78	126.14
36828.	0.419E-05	352.	33.08	144.11	130.77
36830.	0.464E-05	352.	32.72	149.52	135.00
36832.	0.496E-05	351.	30.26	154.37	140.27
36834.	0.482E-05	351.	25.96	158.28	146.40
36836.	0.494E-05	349.	20.29	160.86	152.74
36838.	0.478E-05	348.	13.59	162.45	158.70
36840.	0.425E-05	349.	6.21	163.44	162.96
36842.	0.422E-05	349.	-1.31	163.91	163.40
36844.	0.437E-05	350.	-9.00	164.78	160.29
36846.	0.401E-05	353.	-16.14	165.89	155.20
36848.	0.348E-05	356.	-22.46	167.69	149.90
36850.	0.360E-05	358.	-27.69	170.67	145.23
36866.	0.380E-05	350.	-5.59	199.28	154.14
36868.	0.384E-05	351.	2.03	199.72	157.86
36870.	0.372E-05	348.	9.58	200.31	159.78

MJD	-P	Z	Φ	D.R.A.	Ψ
36872.	0.408E-05	347.	16.67	201.34	159.22
36874.	0.424E-05	349.	22.97	203.19	156.48
36876.	0.423E-05	351.	28.14	206.32	152.36
36878.	0.389E-05	351.	31.67	210.64	147.88
36880.	0.382E-05	351.	33.18	215.76	143.65
36888.	0.324E-05	389.	19.07	231.53	131.39
36890.	0.324E-05	413.	11.90	233.18	128.44
36892.	0.330E-05	351.	5.08	232.74	126.73
36894.	0.333E-05	353.	-2.57	233.04	123.32
36896.	0.345E-05	352.	-10.06	233.37	119.34
36898.	0.356E-05	355.	-17.15	234.28	114.66
36900.	0.381E-05	354.	-23.43	236.11	109.50
PERIGEE IN SUNLIGHT					
36902.	0.374E-05	354.	-28.49	239.11	104.19
36904.	0.378E-05	355.	-31.85	243.19	99.18
36906.	0.384E-05	359.	-33.21	248.52	94.46
36908.	0.378E-05	358.	-32.32	253.54	91.02
36910.	0.344E-05	355.	-29.34	257.88	88.88
36912.	0.312E-05	370.	-24.63	261.07	88.18
36914.	0.329E-05	349.	-18.38	263.43	88.67
36916.	0.336E-05	350.	-11.43	264.35	90.62
36918.	0.323E-05	352.	-3.96	264.63	93.35
36920.	0.305E-05	352.	3.71	264.83	96.21
36922.	0.254E-05	425.	12.90	267.30	97.52
36924.	0.236E-05	348.	18.16	266.04	100.62
36926.	0.352E-05	351.	24.30	267.98	101.14
36928.	0.364E-05	354.	29.13	271.08	100.26
36930.	0.344E-05	347.	32.14	274.81	98.37
36932.	0.329E-05	348.	33.22	279.92	94.80
36934.	0.357E-05	360.	32.15	285.26	90.22
36936.	0.438E-05	345.	28.89	289.28	85.53
36938.	0.541E-05	336.	23.80	292.51	80.38
36940.	0.507E-05	348.	17.61	294.21	75.80
36948.	0.405E-05	353.	-12.13	296.08	61.52
36950.	0.397E-05	355.	-19.04	297.17	58.67
36952.	0.394E-05	356.	-25.03	299.30	55.68
36954.	0.414E-05	358.	-29.65	302.62	52.39
36956.	0.454E-05	358.	-32.53	307.65	48.22
36958.	0.498E-05	360.	-33.17	312.92	44.07
36960.	0.572E-05	355.	-31.59	317.79	40.01
36962.	0.627E-05	354.	-28.01	321.91	36.20
36964.	0.666E-05	352.	-22.77	324.86	33.27
36966.	0.721E-05	352.	-16.23	326.90	31.68
36968.	0.746E-05	350.	-9.02	327.79	32.26
36970.	0.694E-05	351.	-1.24	328.50	34.36
36972.	0.569E-05	349.	6.35	328.73	37.83
36974.	0.495E-05	349.	13.75	329.49	41.51
36976.	0.471E-05	350.	20.51	330.97	44.85
36978.	0.439E-05	350.	26.25	333.58	47.27
36980.	0.419E-05	350.	30.48	337.37	48.40
36982.	0.464E-05	352.	32.84	342.39	47.94

MJD	-P	Z	φ	D.R.A.	ψ
36984.	0.456E-05	352.	32.99	347.75	45.85
36986.	0.452E-05	352.	30.94	352.75	42.14
36988.	0.444E-05	351.	26.92	356.80	36.95
36990.	0.481E-05	350.	21.35	359.68	30.51
36992.	0.594E-05	348.	14.68	10.44	25.31
36994.	0.555E-05	350.	7.32	2.35	15.17
36996.	0.540E-05	350.	-0.33	2.83	7.15
36998.	0.571E-05	350.	-8.01	3.42	3.88
37000.	0.571E-05	351.	-15.35	4.48	10.92
37002.	0.503E-05	355.	-22.03	6.51	18.56
37004.	0.577E-05	356.	-27.49	9.48	25.36
37006.	0.502E-05	356.	-31.34	13.88	31.21
37008.	0.466E-05	358.	-33.12	19.32	35.82
37010.	0.527E-05	358.	-32.67	24.99	39.09
37012.	0.520E-05	357.	-30.00	29.94	40.89
37014.	0.529E-05	356.	-25.43	33.95	41.58
37016.	0.555E-05	355.	-19.49	36.51	41.22
37018.	0.614E-05	351.	-12.44	38.19	40.48
37020.	0.663E-05	348.	-4.85	39.08	39.74
37022.	0.701E-05	348.	2.87	39.62	39.56
37024.	0.764E-05	349.	10.46	40.27	40.42
37026.	0.767E-05	349.	17.65	41.65	42.68
37028.	0.570E-05	348.	23.92	43.89	45.96
37030.	0.604E-05	350.	28.89	47.35	49.97
37032.	0.585E-05	351.	32.11	52.04	54.35
37034.	0.580E-05	351.	33.20	57.51	58.66
37036.	0.574E-05	350.	32.05	62.75	62.41
37038.	0.591E-05	349.	28.78	67.35	65.72
37040.	0.628E-05	345.	23.38	71.66	69.29
37042.	0.626E-05	348.	17.41	72.98	70.72
37044.	0.593E-05	349.	10.24	74.21	72.67
37046.	0.583E-05	351.	2.53	74.99	74.80
37048.	0.590E-05	354.	-5.30	75.65	77.28
37050.	0.533E-05	361.	-13.06	77.11	80.86
37052.	0.496E-05	351.	-19.70	77.69	83.53
37054.	0.458E-05	356.	-25.73	80.46	88.04

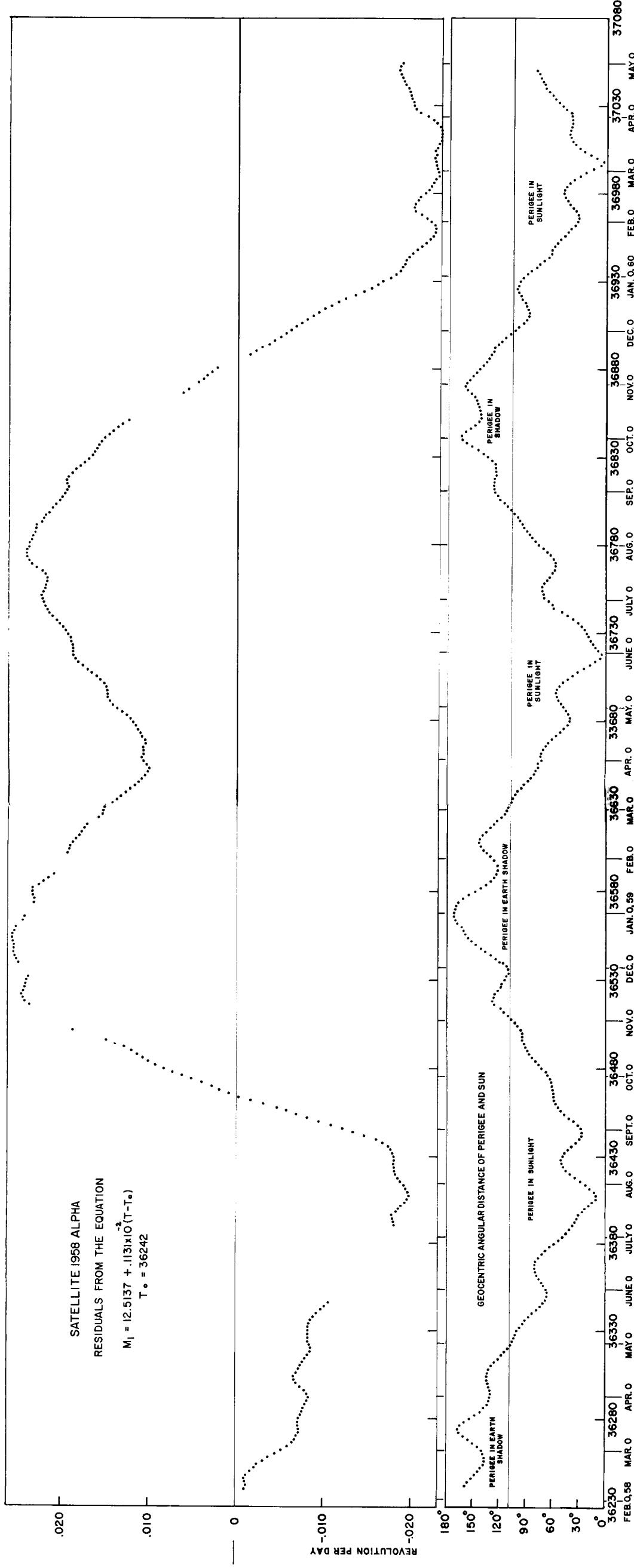


FIGURE 1. - Correlation between mean motion and geocentric angular distance between perigee and sun.

SATELLITE 1958 ALPHA

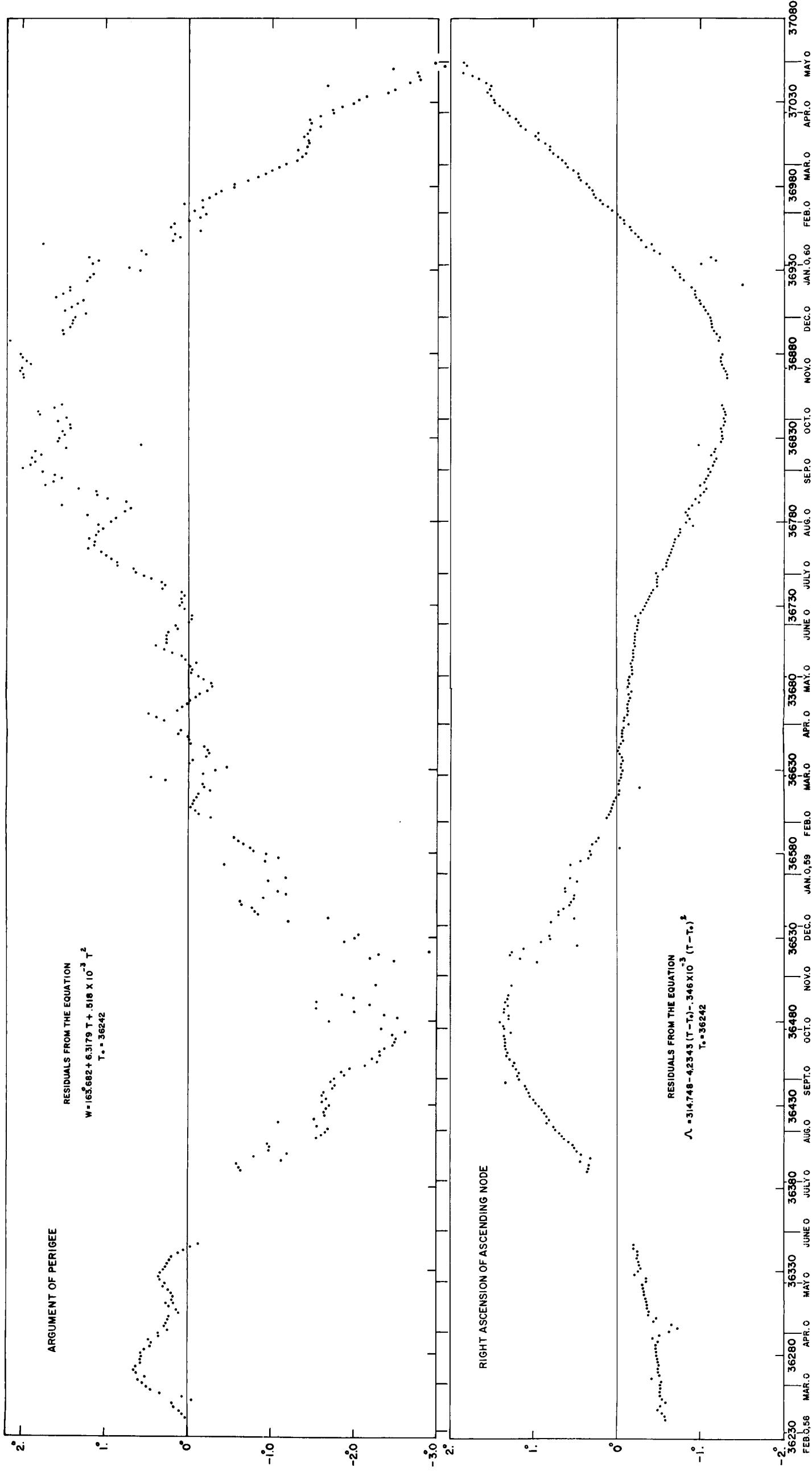


FIGURE 2. - Residuals of the values of the argument of perigee and right ascension of node with respect to quadratic polynomials obtained by least squares fit.

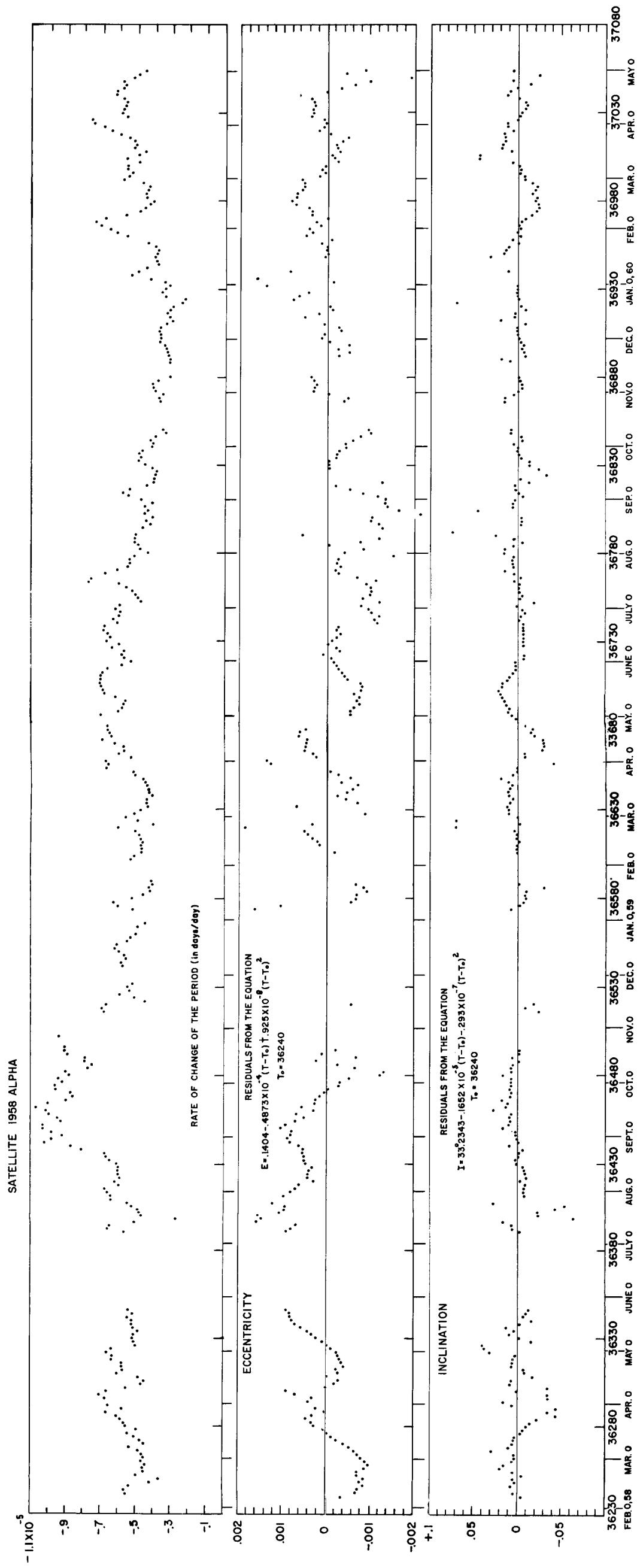


FIGURE 3. - Rate of change of the period and residuals of the values of the eccentricity and inclination with respect to quadratic polynomials obtained by least squares fit.

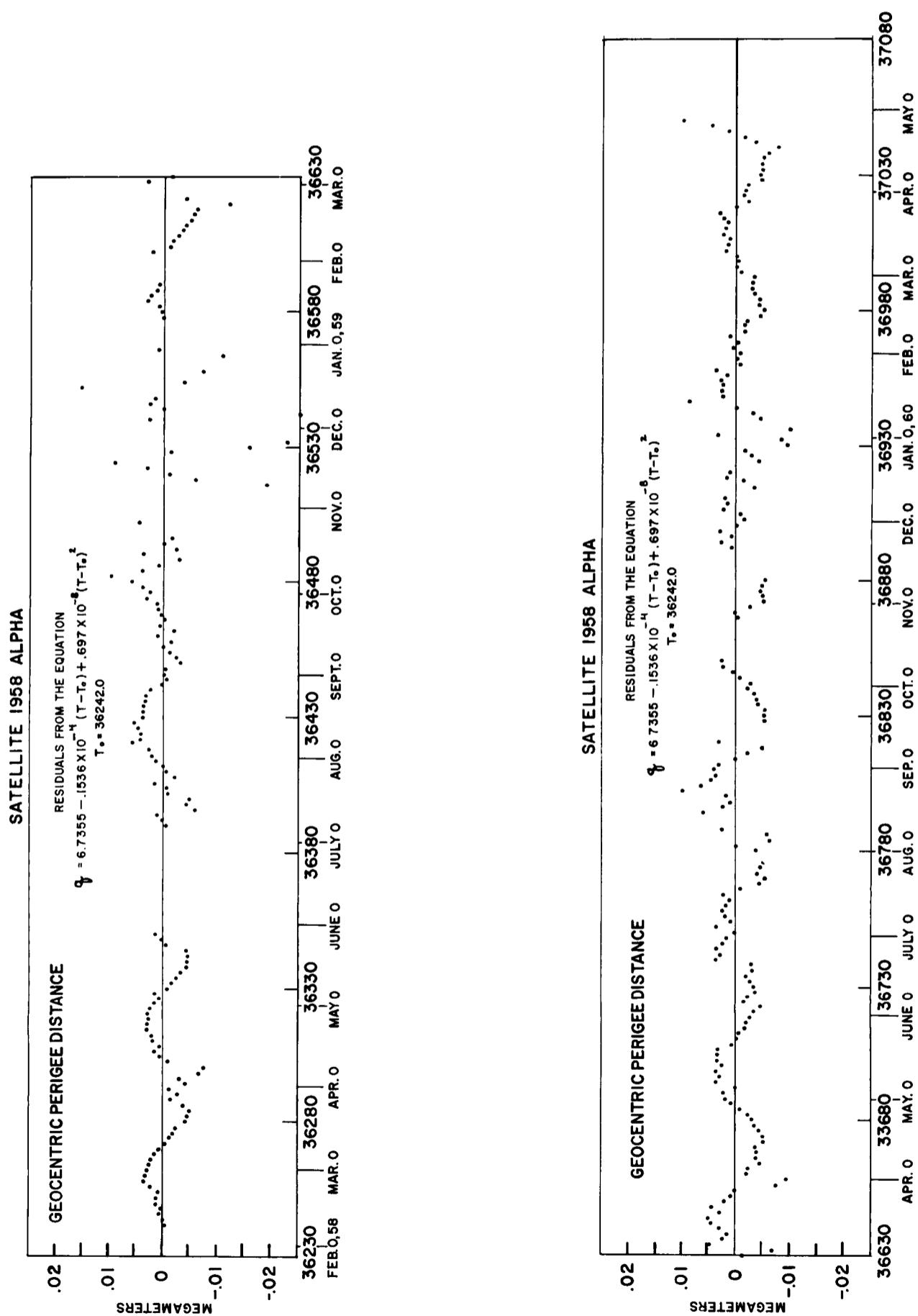


FIGURE 4. - Residuals of the values of the distance between perigee and the center of the Earth with respect to a quadratic polynomial obtained by a least squares fit.

NOTICE

This series of Special Reports was instituted under the supervision of Dr. F. L. Whipple, Director of the Astrophysical Observatory of the Smithsonian Institution, shortly after the launching of the first artificial earth satellite on October 4, 1957. Contributions come from the Staff of the Observatory. First issued to ensure the immediate dissemination of data for satellite tracking, the Reports have continued to provide a rapid distribution of catalogues of satellite observations, orbital information, and preliminary results of data analyses prior to formal publication in the appropriate journals.

Edited and produced under the supervision of Mrs. L. G. Boyd and Mr. E. N. Hayes, the Reports are indexed by the Science and Technology Division of the Library of Congress, and are regularly distributed to all institutions participating in the U. S. space research program and to individual scientists who request them from the Administrative Officer, Technical Information, Smithsonian Astrophysical Observatory, Cambridge 38, Massachusetts.

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